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**Illustrated.*

The Engineering and Mining Journal

Vol. 92. NOVEMBER 4, 1911. No. 19.

The Steel Corporation Suit

The inauguration of an action by the Attorney General of the United States for the dissolution of the U. S. Steel Corporation, on Oct. 26, as a violator of the Sherman law materialized what had long been threatened. With the disturbance which this agitation has produced even the more radical and unreasonable of our citizens should pause to reflect. Here is brought to book the greatest of our industrial corporations, which has developed the greatest economies in mining and manufacturing, which has built up a great export trade in iron and steel products, which has been the model of fairness in its attitude toward its stockholders and employees, which has elicited no complaint of unjust practice, so far as we are aware, from either its competitors or the consuming public. If ever there were a beneficent industrial combination we have been inclined to the belief that it was the Steel Corporation. Unless there be some grounds for action against it more weighty than those whereof we know the assault of the Administration is an amazing outrage, not only upon the company but also upon American industry.

The company itself has been ignorant of its offense against the Sherman law. It is of official record that it has laid bare its history and accounts to the Government. It has sought to have pointed out to it what infringements it might be innocently committing, not merely of the law but of what the Administration conceives to be the law, with a view to their correction. Surmising that its possession of the Hill ore lands might be considered in contravention of the law it officially canceled the lease of them before the suit was brought.

The charges against the company in the Government's brief are chiefly twaddle. It is alleged that it is a monopoly in restraint of trade because of its possession of so large a part of the iron-ore resources of the United States. If there be any danger in that the simple remedy is always open to our people of removing the duty on iron ore and throwing open the matchless resources of Sweden, Cuba and Brazil. Anyway, the Steel Corporation has already divested itself of a large part of its holdings of ore.

The old charge of monopoly by the Tennessee acquisition in 1907 is raised again. In fact, this purchase added but a trifling percentage to the Corporation's capacity and it had the specific sanction of the previous Administration.

Finally, it is charged that the Steel Corporation has conspired to regulate prices. Here we need a definition of what constitutes a regulation of price. If such a conspiracy includes any and all commercial conferences at which the subject of prices be discussed, about all business, corporate and individual, wholesale and retail, must cease as illegal, a conclusion as absurd as Judge Lacombe's famous dictum about the expressmen. If, however, regulation is to be determined by results, that is something wherein the Steel Corporation has signally failed, as everybody acquainted with the trade well knows.

It has been amply proved by experience in the markets for all of the staples that prices can be controlled only when there is a practically complete monopoly or a strong demand. In the absence of a monopoly, upon a falling market competitors immediately undersell and the big interest seeking to maintain its own price is eventually obliged to cut like the others. The big company has generally been able to restrain prices from dangerous advances but never from keeping them from descending to the lowest natural level in times of depression. This has also been the experience of the Steel Corporation.

The real crime of the Steel Corporation consists in its being big and successful. That is enough to excite our stupid and reckless demagogues and egg on politicians to attacks that may win favor with the mob. The Sherman law as construed by the Supreme Court has a

proper place in our statutes for the restraint of unfair practices, but when it is applied to the assailing of honest industrial operations that are building up the greatness of the United States, it is time to call a halt. Perhaps that very thing will come from a legal decision in the steel case, which will serve to determine better than anything else what is the position of a "good" trust—and whether mere bigness be a crime.

Mining in the Far East

Elsewhere in this issue of the JOURNAL the annual report of the Oriental Consolidated Mining Company is abstracted at length. The position of this company is exceptional in that it is the pioneer among American mining companies in the successful working of low-grade mines in the Far East. The scope and character of the operations are not widely known, as the stock of the company is closely held and few mining engineers appreciate that since 1900 this company has paid over $4,000,000 in dividends from an outlay of $100,000 for development, all further capital requirements for the establishment of the extensive and complex operation having been taken out of the mines.

The Oriental Consolidated Mining Company has a concession of approximately 500 square miles in northern Chosen (Korea), and operated last year seven mines, producing over 344,000 tons of ore which yielded $4.49 per ton, and netted a profit of $672,720 or $1.96 per ton. These mines are rather widely scattered, and were repeatedly operated and equipped, but without permanent success, until their management was undertaken by the present company. It has established an organization that is an excellent mining school for the people of the country and has set an example of honest and successful operations that is attracting other capital to the Hermit kingdom, which is now under Japanese control. Another American mining company is at work about 75 miles from the Oriental concession and while its holdings are not so extensive as the latter, the ore is of much better grade.

By reason of its isolation the Oriental Consolidated has been compelled to establish a complete organization that includes besides the usual mining and milling operations, a foundry and machine shop, a hospital, a fleet of three schooners and a cord-wood railway to secure the fuel essential to the operation. Mining is done almost entirely by hand, which was found to be most economical under the labor conditions and the situation of mines. Two of the mines are over 1000 ft. deep and in view of all conditions the mining cost of $1.41 per ton and the total cost of producing and marketing the bullion from the refractory ore of these isolated mines, $2.53 per ton, reflects great credit upon the operating staff. The operation may be said to be typical of a number of foreign low-grade mines that are profitably worked largely by cheap hand labor with results that challenge the records of many American mines fully equipped with modern machinery.

The Petroleum Situation

The petroleum trade has been more or less disturbed for some time past, and unusual competition has arisen. Special efforts were made some time ago by the chief American producer to push its export business in the Far East and in Europe. These met with some success, but have provoked retaliation, and one of the chief European dealers—the Shell Transport and Trading Company—is seeking a foothold in California, with a view to meeting the Standard at home. In part this is due to the increased production all over the world. New districts are being exploited, and some of those already known are increasing their production. In Europe Galician oil is taking a strong hold in the trade and is supplying markets which formerly looked to this country for oil. The Russian producers have not been so aggressive as usual, partly because the Baku production is declining, and partly because the consumption in Russia is increasing.

There is a special cause which has resulted in a degree of unevenness in the trade. That is the great increase in the use of oil engines, especially in motor cars and motor boats. This has brought about a large demand for naphthas or light oils. But to produce these it has been necessary to make much larger quantities of illuminating oils and also of residuum and heavy fuel oils. The result has been a surplus of these oils, and especially of the fuel oils. They are difficult to sell, even at the low prices which have been made. The use of oil fuel is on the increase, but hardly as fast as the supply, and stocks are accumulating all over the world.

Probably this will adjust itself in time as demand grows; but for the time being the oil producers are not altogether in a favorable position. Low prices and excessive supply of certain classes of oil are hardly balanced by the call for other classes. There seems little prospect for the establishment of any agreement, such as those which have prevailed from time to time in the past, and excessive competition is likely to continue.

The committee in charge of the proposed memorial to Samuel Franklin Emmons—to which reference has already been made in our columns—announces that the fellowship in Columbia University, which is the form the memorial will take, will be devoted to the investigation of geological problems, especially those in chemical geology. It seems entirely fitting that the fund should be used for the study of the problems in which Doctor Emmons was so deeply interested and in the elucidation of which he took such a prominent part. We trust that the contributions will soon reach the total of $25,000 which, the committee reports, is necessary to carry out its purpose.

Gold production in the three-quarters of 1911 recently ended seems to have about held its own in most of the minor producing countries. In Australia there has again been a decrease, which seems largely due to labor conditions in that continent and the drawing of men from mining to other industries which are more profitable for the time being. In the United States we have no data for an absolute statement, but it seems probable that there will at least be no increase. The Transvaal, however, has shown a notable gain, and one is expected in Russia also. It is altogether probable the year will make some increase even over the high totals of several years past.

The rebellion in China is assuming a serious importance, and the surrender of the Imperial government to the demands of the insurgents foreshadows its probable success. It does not appear, however, that this will result in opening the mineral resources of the country. The new government, if established, may favor the working of mines by Chinese interests, but seems less favorable to foreign enterprise than the old administration.

Correspondence and Discussion

Views, Suggestions and Experiences of Readers

The Degree of Metallurgical Engineer

I am interested in knowing when and where the degree of metallurgical engineer was first conferred, and would be obliged to any readers of the JOURNAL who would enlighten me. Was the degree of foreign or domestic origin?

L. W. BAHNEY.

New Haven, Conn., Oct. 10, 1911.

[A reply to an inquiry at Columbia University states that the course in metallurgy was established there in 1868 and the first degree (Ph.B.) conferred in 1873. The degree of metallurgical engineer was authorized in 1886 and the first degree granted in 1887. We do not know whether this was the first of such degrees granted in the United States nor whether the degree originated in this country.—EDITOR]

Standards for Mine Maps

In the extremely interesting article, on the subject of standards for mine maps in Great Britain, by H. G. Henderson, published in the JOURNAL of Oct. 21, discussion of the propositions advanced is invited on the well taken ground that, as nothing can be lost by discussing such an important subject as the survey of metalliferous mines, disagreement with the author's conclusions would be as valuable as agreement, provided that cogent arguments are advanced.

It is hard to see where disagreement can arise over such sensible suggestions as were made in reference to the importance of some system of coördination of one set of mine plans with another—and just here let me add that all of the proposed reforms seem as applicable to mines of the world in general as to those of Great Britain. Summarized in single sentences, Mr. Henderson's theorems seem to be:

(1) Mine plans should be plotted to the true meridian, rather than to individual magnetic meridians.

(2) Datum levels from which those of underground workings are reckoned should coincide with those on which surface surveys are based; that is to say, in the case of Great Britain, approximate mean-tide level at Liverpool, in other countries, of course, with the accepted sea-level datum.

(3) In drafting mine plans there should be strict adherence to uniform conventional signs and to unvarying standardization of scales.

For four years I have been operating the gold mines of this district, all of which are owned by members of my family and myself. The Nova Scotia field was wholly new to me at the time of its purchase. Some of the mines had been abandoned; all of them, with one exception, had been operated for periods varying between 10 and 40 years, and to depths varying between 250 and 1000 ft. The one exception was the so called Holman mine, which I opened myself. Most of my time during these four years has been taken up in opening old mines, of which no maps were available. In the endeavor to correlate the laws which govern the mineralization of the anticlinal fold in which they all occur, and to deduce from comparisons between observations made underground and close geological analysis of surface conditions, certain data were needed upon which to base actual mining operations that would prove more profitable than those of the past, because based upon precise scientific knowledge of correlated facts.

I found but one set of mine maps in existence in the district, those fortunately being for the deepest and most important mine, that upon the famous Lake lode. I, therefore, found myself compelled to begin just where the first man started 40 years ago in the compilation of such data in reference to Caribou.

How much easier might have been my task, and how much more significant the results obtained, to say nothing of the saving of time, could I have found accessible a complete and accurate set of mine plans, plotted to the true meridian, with all levels shown, with reference to a standard datum—and that preferably mean sea level—so that approximately accurate conclusions could have been drawn as to the correspondence between various pay shoots, known to exist, but not definitely located upon any existing map or covered by any set of field notes or assay plans.

I believe the suggestions made by Mr. Henderson and by his predecessors in this line of thought, whom he cites, Messrs. Sopwith, Brough and Ramsay, should be enacted into positive law in every metalliferous mining district in the world. The individual owners and operators for the time being of a mine are not the only persons concerned in its proper development. Posterity has claims upon the consideration of those who, while exhausting *pro tanto* its mineral resources, may also be destroying the evidence upon which future operations in its own or neighboring workings should be predicated, but considerations of safety of those who may, contemporaneously or in future, be engaged in labor in mine workings demand accurate and complete mapping on a scale of uniformity that shall approximate as closely as human facilities permit, to absolute standardization.

C. VEY HOLMAN.

Caribou Gold Mines, Nova Scotia, Oct. 25, 1911.

Headframes for Winze Hoists

In the JOURNAL of July 29, in the pages devoted to "Details of Practical Mining," a headframe was described for supporting the sheave of a hoisting system at the top of the winze. Several such schemes have, from time to time, been described in the JOURNAL and, of course, there may be reasons for such installations, but ordinarily it would appear to me to be unnecessary, and certainly in soft ground impossible or extremely costly to support such a large piece of ground in order to accommodate a headframe. Of course, if only ore would be cut, the cost would not be much more than stoping.

However, if there is a level above the collar of the winze, it would require less excavation, if the levels are at the usual vertical distance apart, to continue the winze up to the level above, then crosscut to one of the main drifts, cutting a room in the crosscut for the hoist. Then the sheave could be supported by timbers resting across the collar of the vertical pass between the two successive levels.

In case there is no level above or the lift is too great, it would be an easy matter to raise 20 or 30 ft. then to cut a short drift at the top of the raise, enlarging the end into a room large enough to contain the hoist. The sheave could be supported on timbers hitched into the walls of the raise near the top. The rope would pass horizontally along the short drift, over the sheave and down to the bucket.

The drawback to the last method is that there would be no ventilation and but one narrow exit from the hoist room. The ventilation could be induced by a small fan connected to the hoist and an intake pipe coming up from the level below. The advantages of the scheme would be, less excavation if the site were in rock, and greater security in supporting the roof of the smaller excavation if in soft ground.

COROCORO.

Caldera, Chile, Sept. 14, 1911.

September Operations at Goldfield Consolidated

During September, 1911, the Goldfield Consolidated company produced 26,760 tons of ore, which contained $676,383, or an average of $25.28 per ton. Of this, 26,679 tons were milled with an average extraction of 94.11 per cent. and 81 tons were shipped which averaged $77.12 per ton. Net recovery from all ore was $23.80 per ton, and the total net profit was $444,366, or $16.60 per ton. During the month 3192 ft. of development work were done.

SEPTEMBER COSTS AT GOLDFIELD CONSOLIDATED

Mining:		
Development	$0.88	
Stoping	2.34	
		$3.22
Transportation		0.07
Milling		2.22
Marketing		0.93
General expense		0.42
Bullion tax		0.19
Marketing ore shipped		0.05
Construction		0.18
Total cost of operation		$7.28
Miscellaneous earnings		0.08
Net cost per ton		$7.20

At the Clermont, the 466 intermediate between the 600- and 750-ft. levels was extended 80 ft.; crosscuts were driven in two places to the hanging wall, exposing 20 ft. of ore. A raise was also started near the present face. This work produced 707 tons averaging 4.77 oz. This orebody has been found in a raise from the 483 crosscut to 16 ft. above the 750 level. The 420-H raise has broken into the 413 sill floor, intersecting the 413 ore at a point 30 ft. vertically under the sill, and producing 267 tons of ore containing 2.93 oz. through to the sill. The 488 crosscut into the foot wall under the 428-C stope exposed 6 ft. of 2-oz ore. A new stope, 408-D southeast of the old 428, was opened and produced 215 tons worth 1.42 oz. The Grizzly Bear shaft was cleaned out and equipped and sinking is now in progress.

At the Mohawk the new 150-ft. level was completed and provides an efficient means of working the new ore uncovered in the upper workings. No. 21 crosscut from No. 3 drift produced 103 tons worth 1.31 oz., and the new stope from No. 13 drift produced 330 tons worth 2.03 oz. The new sill floor on the 490 intermediate produced 101 tons worth 1.54 oz., and the 490-A raise produced 309 tons, averaging 1 oz. The 101 sill of the Red Top 200 ft. south of the shaft was extended considerably and produced 519 tons, averaging 3.28 oz.; this connects with the 202 stope from the second level. The 305 drift of the Laguna was connected with the Hazel shaft.

Superintendent Thorn states that the low tonnage for the month was caused by shutdowns to enable relining of the tube mills and repairs to the chilean mills. The foundations for the roasting plant and building have been practically completed and construction is progressing satisfactorily. It is stated further that owing to the fact that all the working faces at the Mohawk mine dropped below average, the production was low, but that indications now point to the present month being somewhat above average.

Nevada Consolidated

The official report of the Nevada Consolidated Copper Company for the quarter ended Sept. 30, 1911, gives the production of copper as 15,837,079 lb. compared with 15,677,065 lb. for the second quarter; 15,893,743 lb. for the first quarter of 1911; and 15,698,595 lb. for the last quarter of 1910. The total for the 12 months was 63,106,482 lb. as against 62,772,342 lb. for the preceding 12 months. The production for the last two quarters is divided as follows: April, 5,298,632 lb.; May, 5,277,355 lb.; June, 5,101,078 lb.; July, 5,258,582 lb.; August, 5,249,514 lb.; September, 5,328,983 lb. The copper contents of the ore treated during the last quarter is given as 1.7 per cent.

The sulplus earned during the quarter amounted to $100,555, after payment of the eighth quarterly dividend of $749,389, and charging off $136,990 for Steptoe Plant depreciation.

The stripping of the Liberty pit was continued and 348,568 cu.yd. of overburden removed during the quarter. During July the last reverberatory furnace was altered to operate with oil instead of coal. Basic-lined converter No. 1 is now in operation and the work of installing No. 2 is under way.

Chronology of Mining for October, 1911

Oct. 6—Calumet & Hecla company announced the abandonment of the merger plans.

Oct. 10—Opening of the 101st meeting of the American Institute of Mining Engineers in San Francisco.

Oct. 18—Explosion in Bardot coal mine, France, killed 26 men.

Oct. 19—Raritan Copper Works instituted suit against the Government for recovery of platinum contained in gold delivered to New York Assay Office.

Oct. 20—New Langdon shaft of Wharton Steel company at Hibernia, N. J. flooded and 12 men drowned.

Oct. 21—Explosion in a mine at Trabonella, Italy, reported to have killed or injured 100 men.

Oct. 22—Fire damaged Kingdon shaft of Old Dominion company at Globe, Arizona.

Oct. 23—Explosion in O'Gara mine No. 9, at Harrisburg, Ill., killed 8 and injured 10 men.

Oct. 24—The 14th annual session of American Mining Congress opened in Chicago.—Fire destroyed Butte Reduction Works at Butte, Mont., entailing $350,000 loss, one-half insured.

Oct. 26—Steel Corporation officially announced intention to cancel Great Northern ore lease and to reduce freight rates 20c. per ton on its Minnesota range roads.—Government filed suit in Trenton, N. J., against Steel Corporation, its subsidaries and officers, under Sherman anti-trust law.

October Dividends

The accompanying table shows the amount per share and the total amount of the dividends paid during October, 1911, by a number of mining and industrial companies in the United States, Canada and Mexico.

The dividends shown in the table for October, 1911, amount to $14,437,770 as against $10,583,474 for October, 1910, while the dividends by mining companies and allied industries as reported to the JOURNAL amount to $159,195,054 for the first 10 months of this year as against $138,314,604, last year.

UNITED STATES MINING COMPANIES	Situation	Per Share	Total
Am. Zi., Ld. & Sm., z.l.	U. S.	$0.50	$40,060
Anaconda, c	Mont.	0.50	3,000,000
Bunker Hill & Sul., l.s.	Ida.	0.05	65,400
Copper Range Con., c.	Mich.	0.75	288,750
Centen'l-Eureka, l.s.g.c.	Utah	3.00	300,000
Daly West, s.l.	Utah	0.30	54,000
Elkton Con., g	Colo.	0.01½	37,500
Goldfield Con., g	Nev.	0.50	1,779,424
Homestake, g	S. Dak.	0.50	109,200
Hecla, s.l.	Ida.	0.02	20,000
Iron Blossom, s.l.g.	Utah	0.07	70,000
Klar-Piquette, z	Wis.	0.25	5,000
New Idria, q	Cal.	0.30	30,000
North Butte, c	Mont.	0.30	123,000
Old Dom., C. M. & [illegible], c.	Ariz.	1.00	162,000
Portland, g.	Colo.	0.02	60,000
Tonopah, s.g.	Nev.	0.40	400,000
Tonopah-Belmont, s.g.	Nev.	0.25	375,000
Vindicator, g.	Colo.	0.03	45,000
Wolverine, c	Mich.	4.00	240,000
Wasp, No. 2, g	S.Dak.	0.02	2,958

COAL, IRON, INDUSTRIAL AND HOLDING COMPANIES	Situation	Per Share	Total
Am. Ag. Chem.	U. S.	$3.00	$544,590
Am. Coal. Products	U. S.	1.62½	169,290
Am. Sm. & Ref., com.	U. S.	1.00	500,000
Am. Sm. & Ref., pfd.	U. S.-Mex.	1.75	875,000
Cen. Coal & Coke, com.	Mo.	1.50	76,875
Cen. Coal & Coke, pfd.	Mo.	1.25	23,437
Consolidation Coal	Md.	1.50	285,388
Gen'l Chem., pfd	U. S.	1.50	150,000
Guggenheim Expl. Co.	U. S.-Mex.	2.50	519,832
H'rbison-W'lk'r R., pfd.	U. S.	1.50	144,000
Island Creek Coal	U. S.	1.50	75,000
Nat'l Carbon, com	U. S.	1.50	82,500
Old Dominion of Maine	Ariz.	0.50	146,622
Penn Salt	Penn.	3.00	180,000
Pittsburg Coal, pfd.	Penn.	1.25	271,262
Republic I. & S.	U. S.	1.75	561,465
Sloss Sheff. S. & I.	U. S.	1.75	117,250
U.S. Sm., Rf. & M., com.	U. S.-Mex.	0.50	175,505
U.S. Sm., Rf. & M., pfd.	U. S.-Mex.	0.87½	425,286
Virginia-Caro. Chem.	U. S.	2.00	360,000
Vulcan Detinning, pf.	N.J., Ill	1.75	26,250
Westmoreland Coal	Penn.	1.75	105,000

CANADIAN, MEXICAN AND CENTRAL AMERICAN COMPANIES	Situation	Per Share	Total
Buffalo Mines Co. s.	Ont.	$0.05	$50,000
Esperanza, g.s.	Mex.	0.36	166,188
La Rose, s	Ont.	0.10	149,480
Lucky Tiger Com., g.	Mex.	0.05	35,767
McKinley-Dar. Sav., s.	Ont.	0.10	224,769
Nipissing, s	Ont.	0.37½	450,000
Nova Scotia S. & I., pf.	N. S.	2.00	20,600
Nova Scot. S. & I., com.	N. S.	1.50	90,000
San Toy, l.s.g.	Mex.	0.15	60,000
Temiskaming, s.	Ont.	0.03	75,000
Temis. & Hud. Bay, s.	Ont.	3.00	23,283
Wettlaufer-Lorrain, s.	Ont.	0.05	70,830

Bucyrus Company Extension

The Bucyrus Company, manufacturing dredging and other earth-handling equipment, has recently increased its capital stock to $10,000,000 authorized, $8,000,000 issued. New shops are being erected at Evansville, Ind., where, in addition to other products, the manufacture of wire-rope shovels as well as chain shovels, will be conducted. The present works at South Milwaukee, Wis., will continue to be operated.

The Bucyrus Company now builds dredges, wrecking cranes, pile drivers, drag-line excavators, ballast plow unloaders and steam shovels of the heavier type, and it proposes to bring out a full line of light revolving shovels, weighing up to 40 tons; it will also take up the manufacture of other types of earth-handling and excavating machinery.

Although Bucyrus dredges are now in operation in Russia, India, Alaska, South America, the Philippines and Hawaii, and its steam shovels in Norway, Sweden, Germany, Spain, Siam, Africa, Australia, Alaska, Cuba and South America, it has never solicited foreign trade, as its capacity has been practically all taken up with the home demand. It proposes hereafter to give more active attention to the development of export business, and with increased facilities and augmented capital to extend its business to all parts of the world.

The personnel of the new company will be as follows: H. P. Eells, who has been president of the former company since its organization, will be chairman of the board of directors; William W. Coleman will be president; E. K. Swigart, vice-president, and Dan P. Eells, treasurer. The board of directors will include, besides these, the following: O. H. Cutler, president of the American Brake Shoe and Foundry Company; W. H. Marshall, president of the American Locomotive Company; A. H. Lockett, of Pomroy Brothers, bankers, New York; D. E. Pomroy, vice-president of the Bankers Trust Company, New York; G. W. McGarrah, president of the Mechanics and Metals National Bank, New York; H. H. Dean, of Edward B. Smith & Co., bankers, Philadelphia; G. F. Steedman, president Curtis & Co. Manufacturing Company, St. Louis, Mo., and J. B. Terbell, vice-president of the American Brake Shoe and Foundry Company. G. A. Morison, who was secretary of the old company, will continue in the same capacity for the new organization.

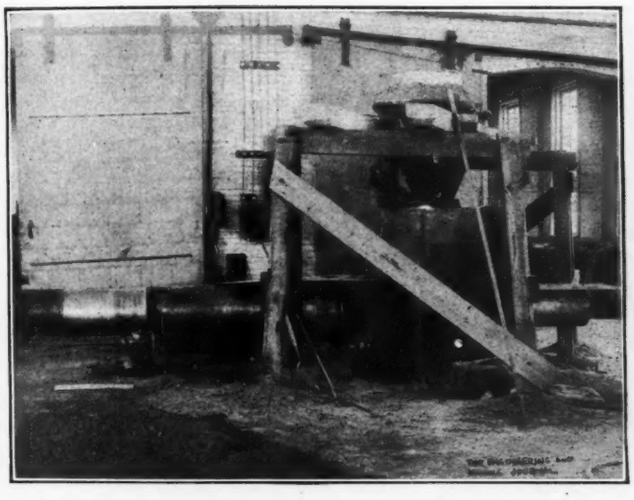
Repairing a Large Crusher Shaft

A repair of unusual size was made at the plant of the Goldschmidt Thermit Company, in Jersey City, N. J., on Oct. 21, when the two pieces of the broken central shaft of a large gyratory crusher, belonging to the North River Stone Company, of Kingston, N. Y., were successfully joined with Thermit. The shaft was 18 ft. long, and the diameter varied from 12 to 22 in., being 14 in. at the fracture. In preparing the two ends for the weld, they were properly supported in a horizontal position, sufficiently raised from the ground and with a space of 2½ in. between the ends to be welded, to permit the Thermit steel to flow in between and to fuse with the metal of the shaft. A mold of wax was constructed to fill this space and to extend 7 in. from the fracture lengthwise each way toward the distant ends of the shaft. At the fracture this mold was 2 in. thick and tapered toward its ends. The wax thus formed a collar 14 in. long and 2 in. thick at the fracture.

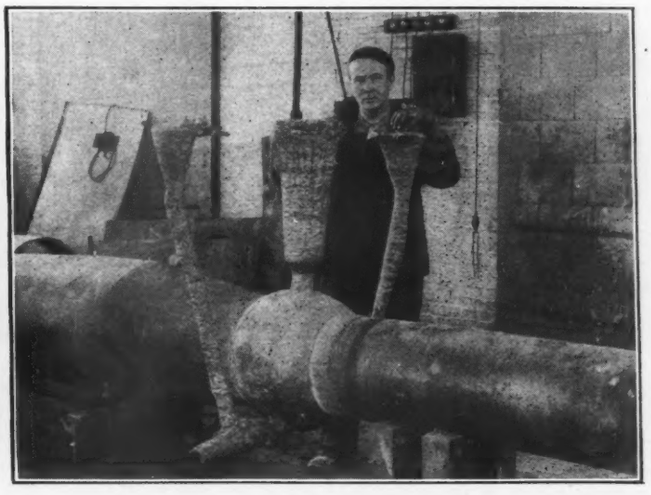
Around the wax mold a sheet-metal box was built up and packed with ground firebrick and clay. Two vertical openings leading to the wax mold were left in opposite corners for risers; an opening was also left from the mold, sloping gently downward, to permit a gasolene blast to be introduced for preheating; this operation melts and drives off the wax, besides baking the fireclay mold and heating the shaft. Over each vertical opening was supported a funnel-shaped crucible, the two containing 1100 lb. of Thermit, with which was mixed 25 per cent. of small steel punchings, 1 per cent. of chromium Thermit and 1 lb. of pure, carbonless manganese. After preheating the mold for 10 hours, the charge was then ignited at the top of each crucible and the reaction immediately took place in the crucibles accompanied by a display of sparks, a peculiar whitish-yellow flame and dense smoke. In the reaction the molten steel settles to the bottom of the crucible and the slag floats on its surface. When this point was reached the crucibles were tapped into the mold. Following this the shaft was permitted to cool for about 40 hours, before the weld was investigated.

The accompanying illustrations show the shaft undergoing the preheating and the position of the sheet-metal box inclosing the mold; also the shaft as it looked after the repair was made and the inclosure removed. The latter illustration shows well the position of the risers which are cut off with an oxy-acetylene flame; the remaining metal is of the same shape and size as the original wax mold. It is claimed that the collar thus formed insures greater strength than the shaft originally possessed.

Thermit, it will be recalled, is a patented mixture, consisting mainly of finely divided aluminum and iron oxide. When ignited in one spot, the combustion so started continues throughout the mass without supply of heat or power from outside and produces superheated liquid metal and superheated liquid slag, the latter being aluminum oxide. By determining the quality of the steel, of which the parts to be welded are made, it is possible to add various materials to the



PREHEATING CRUSHER SHAFT PREVIOUS TO WELDING



COMPLETED THERMIT WELD SHOWING RISERS

charge of Thermit, so that the composition of the welded portion will, to all purposes, agree with that of the main body. As a general thing, however, the charge is intended to be so prepared that the resultant metal shall be stronger than the original.

American Mining Congress

The fourteenth annual meeting of the American Mining Congress was held in Chicago, Oct. 24 to 28, inclusive. Features of this meeting were the addresses of President Taft and Secretary of the Interior Fisher which showed the Government's attitude toward the mining industry, especially as regards the situation in Alaska.

The holding of the convention in a coal State naturally had its influence in determining the character of the program. As indicated in the last issue of the JOURNAL subjects of especial interest to the coal industry formed a large portion of the program. Papers on the prevention of accidents in coal mines, workmen's compensation, conservation applied to coal mines, economics of the coal industry and kindred subjects, were presented. These are timely topics and the thorough discussion of them should result in benefit to coal operators and miners alike.

Among the subjects of more general interest discussed was that of conservation. Secretary of the Interior Fisher, in an address on Friday evening, set forth the conditions in Alaska as he found them on his recent visit. Based on his observations as to the needs of the case, Secretary Fisher has outlined a method for meeting the Alaskan situation which is approved by President Taft and will have his support. Close control of transportation is recommended and if a monopoly cannot be averted by any other means the Government may enter the field as a competitor. Exclusive control by the Government is opposed, however, as Secretary Fisher believes that this should not be considered unless private enterprise cannot be satisfactorily controlled.

The mining and selling of coal is not considered to be a function of the Government and is not likely to be resorted to. It is proposed to meet the difficulties by a leasing system, thus opening up the land for development by encouraging the entry of private enterprise.

The requisites of the proposed leasing system are outlined as follows: Only sufficient lands should be leased to meet the existing market and encourage its development. Quantity leased to any one lessee limited to what can be profitably mined, yet large enough to attract investors. Lessee shall pay royalty as he mines the coal. Annual amount shall be at a fixed minimum, which will prevent holding land without production. Mining to be accomplished without unnecessary waste and with due regard to health and safety of employees. Lessee shall not engage in combinations, agreements or understandings to control price of coal. Revenues derived by Government not to be used as source of federal revenue or substitute for taxation, but for development of State or territory in which the coal is mined. These are based on mistakes seen in existing systems and on recognized needs of the territory.

"What is desired in Alaska," said Secretary Fisher, "is prompt action by Congress in some direction that will promote development. For the present these ideas are offered as definite suggestions for a policy under which the territory of Alaska may be immediately opened for wise and vigorous development."

At an earlier meeting the subject of leasing had been discussed, Dr. George Otis Smith, of the U. S. Geological Survey upholding the Government policy and Gov. William Spry, of Utah, opposing it.

"If we wait for the Government to discover the minerals and make the land ready for extracting them," said Governor Spry, "future generations will be left unprovided for. I am not fighting conservation, but I think certain views are too extreme. I do not think we are in any such peril as has been said."

George E. Baldwin, of Valdez, Alaska, voiced the opinion that "Alaska is being reserved to death. It is being starved in the name of conservation."

President Taft delivered an address on Saturday morning, in which he stated that the mining industry ranked next to agriculture in importance, and for that reason he was glad that Congress had passed a law creating the Bureau of Mines. The President heartily indorsed the Alaskan policy outlined by Secretary Fisher, and stated that if the Secretary would straighten out the tangle so that the territory's resources could be properly developed, he would earn his personal gratitude.

At a previous meeting of the American Mining Congress, a committee was appointed to take up the matter of a general revision of the mineral-land laws. The plan as outlined by Edmund B. Kirby, chairman, is to introduce to Congress at the coming session a resolution providing for the appointment of a committee to prepare a mode of procedure for the general revision of the mineral-land laws.

Upon taking the matter up with governors and United States senators in the States most affected, the committee found that there was a general approval of the undertaking, and support has been promised. After Congress has empowered some committee to act, the committee of the Mining Congress hopes to be able by detailed information and suggestions to aid in preparing a plan acceptable to Congress and satisfactory to the mining industry.

Utah Copper Quarterly Report

The report of the Utah Copper Company for the third quarter of 1911 shows that 1,273,373 tons of ore were treated as against 1,060,414 tons for the previous quarter. Of this tonnage, the Magna plant handled about 83 per cent. and the Arthur plant 17 per cent. The ore treated at both plants averaged 1.4829 per cent. copper as compared with 1.6332 per cent. for the preceding quarter.

The gross production of copper for the quarter was 25,851,456 lb. as compared with 24,469,812 lb. for the previous quarter and 21,296,709 lb. for the first quarter of 1911.

By months the copper production thus far in 1911 is as follows: January, 6,707,116 lb.; February, 7,329,326 lb.; March, 7,260,267 lb.; April, 8,169,248 lb.; May, 8,391,879 lb.; June, 7,908,685 lb.; July, 7,555,406 lb.; August, 9,010,669 lb.; September, 9,285,381 lb. The average monthly production for the first three quarters of 1911 was 7,957,553 lb. as against 7,834,188 lb. for the last three quarters of 1910.

The average cost per pound of net copper produced is given as 7.56c., the lowest in the company's history. The total net profit for the quarter was $1,538,712, of which $1,177,012 was paid out in dividends.

Five remodeled sections of the Arthur plant are now in operation and the sixth one is nearly completed. When the 13 sections are completed it is estimated that the Arthur plant will have a daily capacity of 8000 tons. This, with the 12,000-ton capacity of the Magna plant, will give the company a daily capacity of 20,000 tons.

Of the total ore treated for the quarter, about 24 per cent. came from underground mining and 76 per cent. from the steam shovels. The increased rate of stripping was continued throughout the quarter with the result that 1,595,095 cu.yd. of capping were removed as compared with 1,395,504 for the second quarter.

Philippine Mineral Production

An advance statement from the latest bulletin on "Philippine Mineral Resources," gives the total value of the production in 1910 at 2,046,169 pesos, or $1,023,085. The items of production, in dollars, are: Gold, $154,430; iron, $10,011; coal, $88,128; cement, stone, lime and other constructive material, $770,516. The gold was chiefly from the province of Ambos Camarines; the iron was entirely from small native mines and furnaces. The coal was mined on the island of Cebu.

The Ducktown Sulphur, Copper and Iron Company, Ltd., has declared an extra dividend of 10 per cent., payable Nov. 1, 1911, on the ordinary shares.

Details of Practical Mining

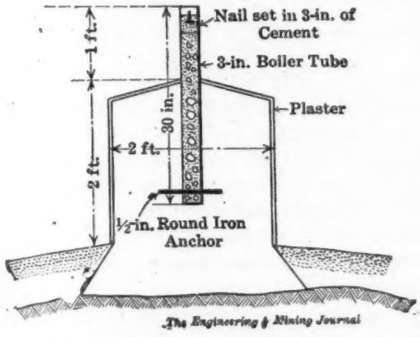
This department is designed to treat in a brief way of details of everyday practice. Many readers are doing interesting things in mining and milling that other readers like to know about. The thought that there is nothing new in them should not be a deterrent to telling about them. Something that is an old story in one district may be quite unknown in another. Our draftsmen can develop any kind of a pencil sketch that is intelligible. A blueprint answers all the purposes of the engraver. Contributions are solicited.

Notes of Interest to Prospectors and Operators of Small as well as Large Mines Things that have to be done in Everyday Mining

A Mine Triangulation Station

By W. R. Hodge*

It is difficult to keep a survey station of any sort in the Mexican hills unless it is scribed deeply in the solid outcrop. Wooden stakes and iron pins are both carefully removed by the natives and taken home, perhaps to be added to private museums. A wooden triangulation station vanishes overnight and helps cook the matutinal *frijoles* of the guileless *pilado*. Masonry monuments do not disappear as quickly,



Concrete Survey Monument

as they are supposed to mark claim boundaries and as such to be under the direct protection of the Mexican government.

The monument shown in the accompanying cut resulted from these conditions. It was built of rock, of which there was a plentiful supply about the site of the station, by a native mason who could erect three stations per day. The cost per station for material and labor was about 80c. When painted white such a station is easily distinguishable by the naked eye from almost all the other stations of the system. The boiler tube used came from the scrap pile, as did the anchor iron. The tube, after being set in place vertically, was filled to within 4 in. of the top with rock and mortar. On top of this filling was run 3 in. of cement, in which was embedded a nail, head down. As the station was but 3 ft. high it was a simple matter to set the transit over the nail point.

A variation of this station was used at some of the mines near Guanajuato. The tube was made about 5 ft. high and threaded at the top to fit a transit head. The head was screwed directly to the tube and the instrument leveled. So far as I know, no station of this kind has been destroyed by mischievous natives.

*Mining engineer, Houghton, Mich.

The Eclipse Filter

The Eclipse filter, a recent invention of H. Wallace, of the Associated Gold mine, Kalgoorlie, is described in the *Min. and Eng. Rev.*, Aug. 5, 1911. The machine consists of a wooden frame, with horizontal rollers supporting a perforated endless belt and vertical rollers for folding and squeezing the belt which carries the slime. Over the whole length of the belt is laid a strip of filter cloth which is stuck to the outside edges by balata gum.

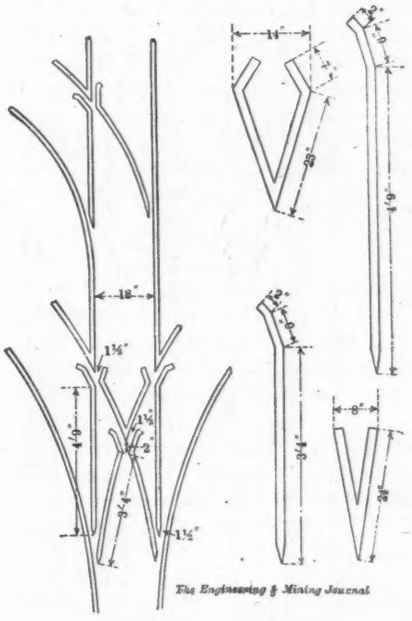
The filtering or squeezing gear consists of a series of cast-iron rollers, suitably driven by bevel gearing underneath the machine. Springs adjusted to 60 lb. pressure are attached to the roller framework; and to keep the top of the belt closed is a patent roller chain, the links of which are so made as not to damage the belt. The squeezing rollers are also the driving rollers for the belt.

In operation the slime is run into the V-shaped opening formed by the belt at the feed end and is carried by the belt through the series of squeezing rolls, which force the solution through the filter cloth into the launder below the belt, whence it flows to the zinc boxes. The cake of slime, with 20 per cent. moisture and 1 in. to 1½ in. thick, now passes the discharge rollers, where an adjustable device scrapes off the slime.

Mine Track Switches

At many mines it is the practice to order standard switches direct from supply companies, while at others the switches are made at the mine, usually by the blacksmith, who makes them according to his own ideas, guided by the data supplied by the foreman of the track-laying crew. Standard switches are expensive when bought from supply houses. Made-at-the-mine switches are comparatively cheap, but unless well made they cause much trouble from cars being derailed.

At the mines of the Tonopah Mining Company the engineering corps designed the switches illustrated in the accompanying sketches. These are made at



One- and Two-way Mine Switches

the company's shops according to standard specifications. They are suitable for tracks where the tramming is done by hand. The car is made to take the turn by shifting the rear end in the opposite direction. The switches are so placed that only the empty cars need be so shifted; the loaded cars, running in the opposite direction, take the straight-away track.

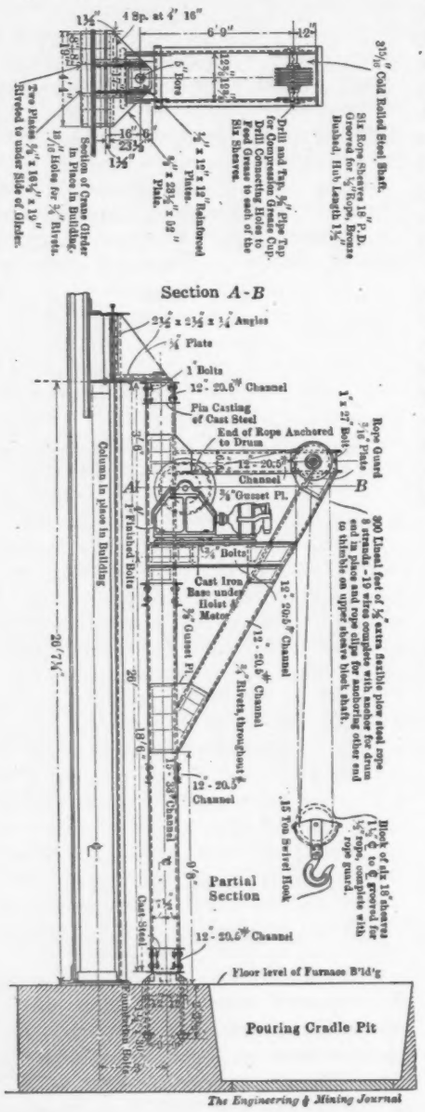
Cleaning Oil Soaked Belts

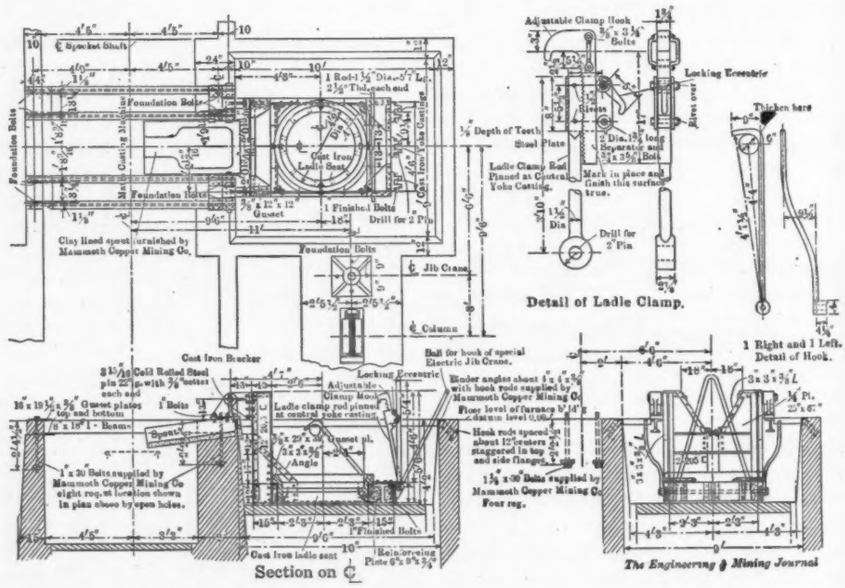
When a belt has become oil soaked and will not stay on the machine, a good method of cleaning it is as follows: Coil the belt loosely in a tub of sufficient size, and cover with whiting. Be sure that the whiting gets in between the coils of the

belt, and it will be only a short time before the whiting will absorb the oil from the leather. It will then only need to be wiped clean to be ready for further service.

Matte Pouring Crane

In the accompanying illustrations are shown the details of the construction of the jib crane and the ladle cradle used at the Mammoth smeltery of the United States Smelting, Refining and Mining




Section on ℄
Detail of Ladle Clamp.
Jib Crane
Foundation Bolts
Cast Iron Bracket
Cast Iron Ladle Seat
Ladle clamp rod pinned at central yoke casting
Locking Eccentric
Adjustable Clamp Hook
Clay Head spout furnished by Mammoth Copper Mining Co.
Floor level of Furnace B'ld'g
Ball for hook of special Electric Jib Crane.
Binder angles about 1" x 4½" with hook rods supplied by Mammoth Copper Mining Co.
Hook rods spaced about 12" centers staggered in top and side flanges.
1¼" x 20" Bolts supplied by Mammoth Copper Mining Co. Four req.
1 Right and 1 Left. Detail of Hook.

MATTE-POURING CRANE AND LADLE CRADLE AT MAMMOTH SMELTERY, KENNETT, CAL.

Company, at Kennett, Cal. A general view of the ladle cradle was published in last week's JOURNAL. Experience showed that it was advisable to use the power-operated cradle in pouring the matte, instead of holding the traveling crane in order to operate this cradle. The matte is poured from the ladle into a casting conveyer which will be described in a later issue, and is afterward resmelted in the blast furnaces.

Loss of Power in Shafting

It is known that all transmission of power takes place at a loss and that friction is the cause of a high percentage of that loss, but it is questionable if the majority of engineers know what is a nominal loss for power transmission and what is abnormal; in other words, what is the minimum loss in good practice. That this statement is true that the allowable losses are not appreciated, or at least, if appreciated, are not heeded by many engineers responsible for the power distribution, has been well proved by recent investigations and tests of the alinement of shafting in certain eastern manufacturing plants. These showed that in many instances the power loss from friction in long line shafting was not only far above the maximum allowable limits of good practice, but exceeded the amount of power actually transmitted to do useful work.

The causes of abnormal friction loss in shafting are not hard to find. They may be due to the following: That the shafting itself is not straight; that the shafting is not level; that it is not in line; that the belts used on the pulleys are too tight; insufficient lubrication; poor babbitting or neglect of babbitting the boxes, and to grit getting into the bearings.

In the case of shafting of large diameter, even if of considerable length, there is little chance of a well turned piece of shafting becoming bent if ordinary caution is observed in handling it, but the long pieces of small diameter, such as are used at mills for driving vanners and concentrating tables, may be bent to an extent that is not apparent by casual inspection, but which is enough to largely increase the friction, by handling in unloading or being left insufficiently protected while construction work is going on and before being put in place.

The leveling and alinement is usually carefully done when the shafting is first put in place. Losses of power from shafting not being level or out of line is directly attributable to neglect in maintaining it in proper position. With the heavy loads and tight belts required in most mine and mill service, the maintenance of the alinement is important and can only be done by frequent testing and adjusting.

One of the most prevalent causes of excessive friction loss, especially in mine and mill work, is tight belting. Most mine and mill machinery is heavy, requires a considerable quantity of power, and runs with a jar or intense vibration. On account of the necessity of placing the shafting where it will be least liable to be splashed with pulp, many of the belts hang from the drive shaft in a nearly vertical position, so that in order to maintain sufficient arc of contact on the driven pulley the belts must be kept tight; so tight that an inordinate pull comes on the shafting, tending to wear the babbitt in the boxes and throw the shafting out of line, as well as rapidly destroying the belt. It is true that in driving mining and milling machinery, more belts are worn out and in less time than in any other work requiring power. Tight belts are the great power evil, and to them can be attributed the cause of short life of mining-machinery transmission; the loss of belting from being used too tight is far greater, usually, than the loss caused by grit and splashing pulp.

Mill shafting is usually placed high above the floor and near the roof, and the driving belts are run nearly vertically in order to keep them as free from grit

and splashing pulp as possible, but at the cost of tight belts and attendant high frictional losses in transmission. It is preferable to use belts at an angle not exceeding 45 deg. with the horizontal, and in many cases if enough time and thought is given, the shafting used in mills can be so placed as to avoid the use of vertical belts, and at the same time permit the shafting being placed in a position fairly free from any chances of being splashed with pulp.

Formulas for Wire Cables

In designing a cableway it is necessary to calculate the deflection that will be caused by the load and by the weight of the rope itself, the length of cable and the cable stresses. The following formulas are published by the Trenton Iron Company for determining these stresses. The formulas for estimating the deflection of a wire cable corresponding to a given tension, or the tension corresponding to given deflections are applicable to single loads in spans where the tension is a constant known quantity.

In Fig. 1, s is the distance between supports or span $A\ B$; m and n are the

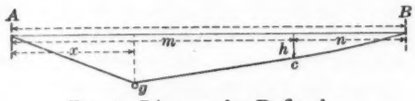


FIG. 1. Diagram for Deflection of Horizontal Cable.
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segments into which the span is divided by a vertical through the required point of deflection c, where m represents the arm corresponding to the loaded side; x is the horizontal distance from load to point of support corresponding with m; w is the weight of the rope per foot; g, the load; t, the tension; and h, the required deflection at any point c. All measures are in feet or pounds.

The deflection due to rope alone is:

$$h = \frac{m\,n\,w}{2\,t},\ \textit{at c; or}\ \frac{w s^2}{8 t},\ \textit{at middle of span.} \tag{1}$$

The deflection due to load alone is:

$$h = \frac{g n x}{t s},\ \textit{at c; or}\ \frac{g x}{2 t},\ \textit{at middle of span.} \tag{2}$$

If $x = \frac{1}{2}\ s$, then

$$h = \frac{g n}{2 t},\ \textit{at c; or}\ \frac{g s}{4 t},\ \textit{at middle of span.}$$

If $x = m$, then

$$h = \frac{g m n}{t s},\ \textit{at c; or}\ \frac{g s}{4 t},\ \textit{at middle of span.}$$

For total deflection:—

$$h = \frac{w m n s + 2 g n x}{2 t s},\ \textit{at c; or}$$

$$\frac{w s^2 + 4 g x}{8 t},\ \textit{at middle of span.} \tag{3}$$

If $x = \frac{1}{2}\ s$, then

$$h = \frac{w m n + g n}{2 t},\ \textit{at c; or}$$

$$\frac{w s^2 + 2 g s}{8 t},\ \textit{at middle of span.}$$

If $x = m$, then

$$h = \frac{w m n s + 2 g m n}{2 t s},\ \textit{at c; or}$$

$$\frac{w s^2 + 2 g s}{8 t},\ \textit{at middle of span.}$$

These formulas are not applicable to cableways where the cables hang be-

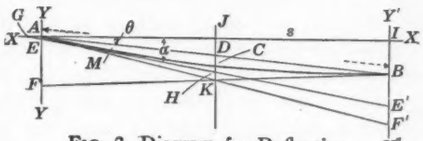

FIG. 2. Diagram for Deflection of Inclined Cable.
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tween fixed points of suspension, excepting for determining the deflection or tension in any case with load at middle of span. In such cases the tension varies with the different positions of the load, the cable being set so that the load, when at middle of the span, where the tension is greatest, shall produce a deflection corresponding to the maximum safe working tension. Knowing the tension at middle of span, the deflection at other points may be determined from the formula:—

$$h = \frac{(w s + 2 g)^2\, x\, z}{2 t\,(w s^2 + 4 g \sqrt{x z})}, \tag{4}$$

in which t represents the tension with load at middle of span, and x and z the segments into which the span is divided by a vertical through the load at any point, the same representation pertaining to the other letters, as in the formulas given.

These formulas may also be applied to spans where the points of suspension are at different elevation, but in this case s should be taken as the length of the cord $A\ C$, Fig. 2, joining the point of suspension (not the horizontal distance $A\ I$), x and z the corresponding segments into which this span is divided by a vertical line through the required point of deflection, and the deflection should be measured vertically from this cord.

The length of the cable is calculated from the formula:

$$l = s + \frac{8 u^2}{3 s}, \tag{5}$$

in which u represents the deflection of the unloaded cable at middle of span. For a cable hung between fixed points of suspension the deflection with load at middle of span only is known, and the deflection of the unloaded cable may be determined from the formula:

$$u = \frac{s e}{4}, \tag{6}$$

e representing the expression

$$\sqrt{\frac{3}{a}(b + b k - 2 a)},$$

in which

$$a = \frac{2 t}{w s + 2 g},$$

$$b = \sqrt{4 a^2 + 1},$$

and

$$k = \frac{1}{6}\left(\frac{w s}{4 t}\right)^2.$$

The value of e in any case should be accurately determined, to do which it will be found necessary in calculating the values of b and $b\ k$ to carry out the figures to many decimal places. Having determined the value of e, the tension of the unloaded cable may be determined from the formula:

$$t_0 = \frac{w s}{2 e}. \tag{7}$$

In the diagram, Fig. 3, the dotted line represents the position of the unloaded cable; the light full curved line, the position of the cable with load at middle of span; and the heavy full line, the curve described by the load. The lowest point of the load for a cable subjected to a constant tension may be determined from the formula:

$$x = \frac{s}{2}\left(1 + \frac{2\,t\ sin.\ \theta}{w s + 2 g}\right), \tag{8}$$

in which x represents the distance measured along the chord $A\ B$, Fig. 2, to a vertical line through the load in its lowest position, and θ the angle which the chord, $A\ B$, makes with the horizontal $X\ X$.

For a cable hung between fixed points of suspension the lowest position of the load can be ascertained by determining the value of x for the lowest position of

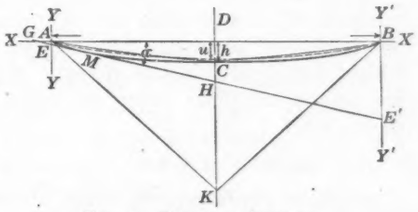

FIG. 3. Diagram showing Lowest Position of Load.
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the unloaded cable, and substituting this for x or z, as the case may be, in Formula 4. In this case we have:

$$x = \frac{s}{2}\left(1 + \frac{2\,t_0\ sin.\ \theta}{w s}\right) = \frac{s}{2}\left(1 + \frac{sin.\ \theta}{e}\right). \tag{9}$$

Hence when $sin.\ \theta = e$ the lowest position of the load is at the lower point of suspension.

Tangents to the curve of the freely suspended cable, or curve described by a moving load on such a cable, at points

equidistant from the point of suspension, will intersect on a vertical line through the middle of span. The distance of the intersecting point of tangents, at the point of suspension below the middle point C of the chord *A B*, Fig. 2, for a constant tension is:

$$y = DK = \frac{ws^2 + 2gs}{4t}, \qquad (10)$$

which for an unloaded cable becomes:

$$y = \frac{ws^2}{4t}, \qquad (11)$$

or the value of *y* in either case is equal to double the deflection of the cable. For the tangent at any other point *M*,

$$y = DH = \frac{ws^2 + 2gs}{4t} - h, \qquad (12)$$

in which *h* represents the deflection of the cable, with the load at point of tangency.

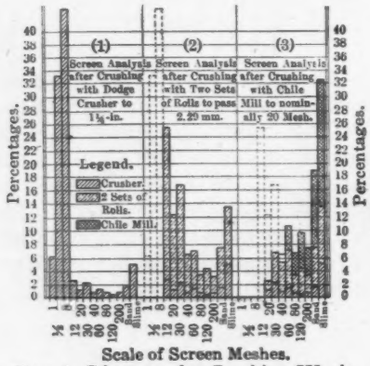
(1)
(2)
(3)
Screen Analysis after Crushing with Dodge Crusher to 1½-in.
Screen Analysis after Crushing with Two Sets of Rolls to pass 2.29 mm.
Screen Analysis after Crushing with Chile Mill to nominally 20 Mesh.
Legend.
Crusher.
2 Sets of Rolls.
Chile Mill.
Percentages.
Scale of Screen Meshes.

FIG. 1. Diagrams for Crushing Work.

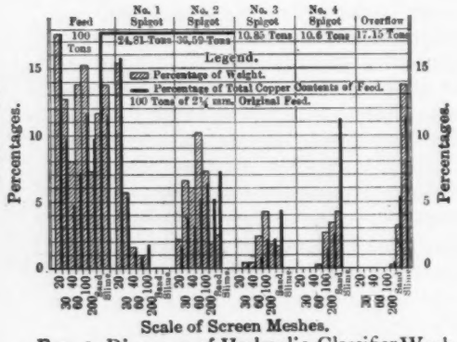

FIG. 2. Diagrams of Hydraulic Classifier Work.

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The intercept of tangent at either point of suspension on the vertical through the opposite point of suspension *A F* or *B F'*=2 *y*. For a cable hung between fixed points of suspension, and tangents at either point of suspension:

$$y = \frac{(ws + 2g)^2}{4wt}. \qquad (13)$$

In the foregoing formulas it should be observed that *t* represents in every case the horizontal component of the cable tension, with load at middle of span. For the tension at either point of suspension:

$$t_1 = t\sqrt{1 + tan.^2\,\alpha}, \qquad (14)$$

in which α represents the angle which the tangent *G E'* makes with the horizontal *X X*. If the points of suspension are at the same elevation:—

$$t_1 = \sqrt{t^2 \times \left(\frac{ws + 2g}{2}\right)^2}. \qquad (15)$$

The cable of an aërial tramway, or conveyor of any kind, traversed by a load in suspension, is subjected to an additional stress due to bending about the carriage sheaves, which stress will depend on the angles of flexure. Assuming that the sheaves are so disposed that the angle of flexure at each is the same, the total tension approximately for deflections not exceeding one-twentieth of the span is:

$$T = \frac{ws^2 + 2gs}{8h} + \frac{ws + 2g}{2nd}, \qquad (16)$$

in which *n* represents the number of sheaves in the carriage on a single cable, and *d* the diameter of the wires of which the cable is composed. For cables of locked-wire construction, *d* will represent the thickness of the outside layer of locked wires.

Illustrating Screen Analyses

By J. M. Callow*

I have lately been using a method of illustrating screen analyses in ore-dressing experiments which to me in many cases is more expressive than curves, especially when it is necessary to show the relationship of weights to values. In the accompanying illustration, Fig. 1 represents a crushing test, Fig. 2 the work of a hydraulic classifier. I trust that others may find them of interest and worthy of adoption.

There are so many ways of illustrating with curves and no two engineers are using the same method, that it would be an advantage to have some uniform method of illustration for this kind of work; as this is simple and would be uniform, I would recommend it to the serious consideration of those who desire to show the results of experiments in crushing and classifying in a simple graphic way.

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WORK OF HYDRAULIC CLASSIFIER

Screen sizes....	+20	+30	+40	+60	+100	+200	—200	Slimes	Total
1st spigot.....	15.36	5.71	1.64	1.04	1.04	.....	.....	.....	24.81
2d spigot.....	2.20	6.58	6.00	10.10	7.32	1.90	2.49	.....	36.59
3d spigot.....	.....	0.39	0.39	2.45	4.21	1.73	1.69	.....	10.85
4th spigot.....	.....	.....	.....	0.21	2.69	3.48	4.22	.....	10.60
Overflow.....	.....	.....	.....	.....	.....	0.13	3.23	13.82	17.15
Feed.....	17.56	12.68	8.03	13.80	15.26	7.24	11.63	13.82	100.00

WEIGHT OF COPPER IN POUNDS

1st spigot.....	322.80	115.2	28.2	20.00	37.20	.....	.....	.....	523.40
2d spigot.....	35.60	80.4	64.80	103.0	126.0	102.20	143.4	.....	657.40
3d spigot.....	.....	6.8	3.60	19.2	45.4	41.80	90.0	.....	206.80
4th spigot.....	.....	.....	.....	1.9	29.0	54.40	225.2	.....	310.00
Overflow.....	.....	.....	.....	.....	.....	2.80	109.80	232.20	344.80
Feed.....	358.4	202.4	96.60	143.6	237.6	201.20	570.40	232.20	2042.40

PERCENTAGE OF COPPER

1st spigot.....	15.80	5.68	1.38	0.98	1.85	.....	.....	.....	25.67
2d spigot.....	1.75	3.94	3.17	5.04	6.17	5.00	7.12	.....	32.19
3d spigot.....	.....	0.33	0.18	0.94	2.27	2.05	4.42	.....	10.19
4th spigot.....	.....	.....	.....	0.07	1.42	2.67	11.02	.....	15.18
Overflow.....	.....	.....	.....	.....	.....	0.14	5.37	11.37	16.88
Feed.....	17.55	9.95	4.73	7.03	11.69	9.86	27.93	11.37	100.11

Protecting Riffles on Wilfleys

At the Steptoe concentrator, Ely, Nevada, George Waddell has made a considerable saving in the cost of keeping the surfaces of the Wilfley tables in good condition by nalling protecting strips of sheet copper on top of the riffles. The copper used is 0.025 in. thick, costing 21c. per lb., f.o.b. New York, and 23.5c. per lb., delivered at Ely. To cover a table 8.75 lb. of copper are required, so that the copper for a table costs $2.05 while the wooden strips to cover a table cost $7 per set. It takes two carpenters a day to cover a table with linoleum, put on riffles and nail on the copper strips, while they can re-riffle two tables in a day. The riffles are nailed 8 to 10 in. apart while the copper strips, which are punched so they will not get bent during the nailing, are fastened to the riffles every 1¼ in. with copper nails. In order to allow for the extra thickness of copper, the riffles are shaved down on the thin end. By means of these strips the life of the riffles has been made four times what it was without the copper strips. It is not the copper that wears out, but the wood that cuts out under the copper. Owing to the difficulty of keeping them straight it would be impractical to use angle-copper strips so as to protect the front face as well as the top of the riffle. A little undercutting does not bother but as soon as the nails are exposed new riffles have to be put on. These strips are used only on the tables treating the coarser sizes of pulp as it is only these riffles that cut out rapidly.

Experiments in Slime Filtration

By George J. Young *

Study of the nature of slime and experiments in filtering said to show that vacuum filters are better for clayey slime; pressure filters for slime with high percentage of sand.

NOTE—Abstract of a paper, "Slime Filtration," presented at the San Francisco meeting of the American Institute of Mining Engineers, October, 1911.

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The physics of slime filtration have been discussed to only a slight extent. The underlying principles are worthy of more intensive study and experimentation than they have received, and the main purpose of this paper is to present the results of such study and experimental work as will serve to make clear in part at least many of the principles which control the filtration of slime.

NATURE OF SLIME

Much has been written concerning an accurate definition of the term "slime," but no comprehensive definition seems to be generally accepted. A slime consists of at least three different substances, each, when separated, possessing distinctly different physical and to a certain extent chemical properties. These substances are extremely fine sand, a colloidal material which may be and generally is in a coagulated condition, and a colloidal material which is in a noncoagulated condition. The distinctive properties of a slime depend upon the relative proportions of fine sand and colloid. No sharp line in the mechanical separation of sand from colloidal material being possible, it is necessary to use a definition which will embody some limitation as to the size of the maximum sand grain. Successive screen sizes have been used; first a 100-mesh screen, then a 150-mesh screen, and, finally, a 200-mesh screen; and this is the accepted present practice in milling work. All material in a pulp finer than a 200-mesh screen is considered as slime. The definition, that a slime is the unleachable portion of a mill pulp, is still in use. A more comprehensive definition than the foregoing is: A slime consists of a mixture of sands finer than 150- or 200-mesh screen with an amorphous clay-like material, consisting principally of hydrated aluminum silicate.

The mechanical appliances in use for filtration are grouped as follows:

I. Suction filters, or filters in which a vacuum is used to accelerate filtration. (*A*) Appliances using a thin slime cake and practically continuous in their action. (Oliver and Ridgway filters.) (*B*) Appliances using a thick slime cake and intermittent in their action. (Moore and Butters filters.)

II. Pressure filters, or filters in which hydrostatic head, compressed air or pumps are used in order to secure greater pressures than are possible with a vacuum pump. These filters are intermittent in their action. (*C*) Ordinary filter presses. (*D*) Sluicing filter presses. (Merrill filter press.) (*E*) Filtering chambers or cylinders; filters in which the filtering basket is inclosed in a cylinder. (Burt, Kelley and Sweetland.)

III. Centrifugal filters, or filters in which centrifugal force is used to separate solution from slime. These filters are continuous in action.

The filters in sections I and II, with the exception of the Ridgway, employ vertical filtering surfaces. The Oliver makes use of a revolving cylindrical surface as a filtering surface. Centrifugal filters are in process of development, and have not as yet secured any foothold in gold and silver metallurgy. It is not improbable, however, that some comparatively simple filter, based on the use of centrifugal force, will be perfected, and will successfully compete with the other forms. At present the suction filters are in greatest use. Of the pressure filters, the ordinary filter presses have gone out of use, except as clarifying presses, and filters of groups *D* and *E* only are in use.

DEVELOPMENT OF FILTRATION

The development of slime filtration is of interest. Filter presses and filtering beds in vats were first used. The filtering beds were soon discarded and the filter press systematically developed. The size of the press was increased, mechanical devices to facilitate discharge and decrease the proportion of labor required were invented and introduced; but in spite of all this the cost of treatment in filter presses remained high. In western America the filter press never received much recognition, but in Australia filter pressing was extensively introduced, and slime was successfully handled by this method. It remained for an American, Charles W. Merrill, to complete the last improvement in the filter press. By the introduction of the sluicing system the slime cakes could be washed out of the filter cells and the press operated without opening or separating the filter plates for each charge. This improvement reduced the labor and cost and increased the effectiveness of the filter press. The Merrill press represents the culminating point in the filter-press line of development in slime filtration.

The Moore filter was the first suction filter in the field, and, while it did not score any very decided success in the first installations, it did attract the attention of metallurgists to the idea involved. While the Moore Filter Company was perfecting the mechanical features of its filter, the Butters filter was introduced, and so many of the difficulties of the Moore filter were overcome in the Butters, that this latter filter received widespread recognition and was introduced into many milling plants. The Moore filter introduced the idea of the canvas-covered filtering cell immersed in the slime pulp and utilizing suction to draw the solution through the walls of the cell and to build up a cake. The necessary transfers are made by lifting the filtering basket out of the pulp. The Butters filter introduced the idea of a stationary filtering cell, and effected the transfers by pumping the slime pulp and wash water from the vat in which the filtering cells were immersed. Both the Moore and the Butters filters have reached a point where little or no further improvement seems possible. Like the Merrill, either one of these systems will satisfactorily meet the requirements of slime filtration.

The combination of the ideas involved in the filter press and the suction filter is seen in group *E*, or the filtering chambers. The Kelley, the Burt and the Sweetland may be compared to a Butters filter installed in a pressure tank.

CONTINUOUS FILTERS

The effort to secure a continuously acting filter has resulted in two important types being developed, of which the Ridgway and the Oliver are the best known. Both of these filters utilize a comparatively thin slime cake. Both operate successfully, and compared with the thick-cake machines have decided advantages, briefly stated as: Simplicity of design; probably lower capitalization charges for equal capacities; lower operating costs; and less attention required in the operation.

With the exception of the Oliver filter, the general method of operation of both suction and pressure filters is the same. The slime pulp is delivered to the filter in the proportion of one of dry slime to from three to one of solution. The pulp is forced into the cells of the pressure filters and a cake formed against the canvas walls of the cells, the surplus pulp, if any, is withdrawn, and wash water forced in until the contained solutions are displaced. The cake is then forced off from the canvas surface, either by water or air or a combination of both, and sluiced out. In the vacuum filter the filtering cells are immersed in the pulp,

a vacuum is formed and a cake built up; the surplus pulp is then withdrawn either by lifting the filtering cells out or by withdrawing the pulp by pumps, and the cakes are immersed in water for washing. In the Moore filter the cakes are discharged by forcing them off from the cell by water or air and dropping into a hopper for sluicing away; in the Butters the cake is forced off in the same way, but while still immersed in the wash solution. The wash solution is then withdrawn, either by decanting or pumping, and the slime cake and surplus wash sluiced out. The Oliver filter performs the operations of cake formation, washing and discharge in continuous sequence. Three steps may be designated as common to all these filters: Cake formation, washing and discharge. The conditions under which slime cakes are formed and washed are the critical points to be considered; the discharge and sluicing away of the cake is a comparatively simple matter and requires no special comment.

Experimental Apparatus

My experimental work was largely confined to suction filtration, and pressure filtration was only briefly studied. The method of carrying out the experiments may be summarized as follows: After trying out several different sizes and types of filter cells a test filter of 0.5-sq.ft. filtering space was decided upon. A ribbed wooden support with ⅛-in. grooves and ⅛-in. ribs was used to support the canvas surface. Brass side strips and a slotted brass bottom strip were used to protect the cake and to assist in measuring.

A type slime was obtained by classifying a pulp from a Tonopah quartzose ore which had been crushed in a stamp battery. The slime was settled by the use of lime, and then by repeated settlement all of the coarse and as much of the fine sand as possible were settled out and removed. The slime pulp remaining was settled to a thickness giving a density of 1.3. Of this slime pulp, 97.4 per cent. passed a 200-mesh screen. Fine sand passing a 100-mesh screen was used in securing the necessary mixtures. The filtrate was measured in a Woulff bottle, to which was attached a vacuum gage. The vacuum was obtained by a small single-acting pump exhausting from a 10-gal. vacuum tank. A short length of hose connected the Woulff bottle with the tank. The slime mixtures were made up in buckets and heated to the temperatures as required. Variations in pressure, temperature and slime were the main points studied.

The rapidity with which a cake may be formed depends upon the filtering rate of the slime, the thickness of the cake, the temperature and density of the pulp and the intensity of the vacuum. The filtering rate of a slime, which is numerically defined in this paper as the number of pounds of water drawn through 100 sq.ft. of filtering surface per minute, depends, for a cake of given thickness, upon the character of the slime, the density of the slime cake, the suction pressure, the temperature and, to a moderate extent, upon the character of the filtering surface and its support. These factors are so interrelated that it is impossible to conduct any series of experiments which would exactly show the effect of varying them. At best the results are approximations.

In carrying out the experiment to determine the variation of the filtering rate with variable thickness of cake, the filter, with No. 10 canvas, was immersed in the pulp for 5 or 10 min. and a cake built up. This cake was then quickly removed, its thickness measured, and the filter immersed in clear water. After determining the filtering rate, the filter was replaced in the pulp and an additional thickness built up. The filtering rate during building up was determined by calculation from the amount of water passing while building to a given thickness. The results indicate that the filtering rate during building up a cake is greater in the pulp than in clear water for thin cakes, while for the thicker cakes the reverse is true.

Effect of Varying Pressure

The effect of variation of pressure upon the filtering rates of cakes of varying thickness was determined. Three pressures were used—11.35, 17 and 21.5 in. of mercury. The last pressure is about the maximum obtainable in Nevada practice. The general effect of increase of pressure is to increase the filtering rate. With thick cakes the effect of an increase of pressure is to increase the density of the cake and thus reduce its permeability. With higher pressures this effect is more marked, and indicates that a point would soon be reached where the increased pressure would result in decreased filtering rate. This is particularly true of slime containing a small proportion of sand, and much less so with slimes containing a large proportion of sand. The practical conclusion that may be drawn from a study of the effects of pressure in filtration is that, with material of a permeable nature such as a sandy slime, increased pressures over those obtainable by means of vacuum pumps are advantageous, while with material in which only a moderate to a small amount of sand is present and the permeability low, the use of higher pressures offers no advantages over those obtainable by vacuum pumps. In the use of both the Moore and the Butters systems, experiments should be made with different intensities of vacuum, for it may be found that a vacuum lower than the maximum obtainable with the available apparatus will give a higher filtration rate, and thus decrease the time for both building up and washing.

The conclusions which may be drawn from experiments with five different slimes are: Slimes from similar ores subjected to the same metallurgical treatment give similar filtering-rate curves; a moderate variation in the proportion of fine sand gives filtering rates differing only to a small degree, while a considerable increase in the proportion of fine sand increases the filtering rate; the proportion of colloidal matter, or, in this case, clay base, has a marked influence upon the filtering rate; much more, relatively, than the effect of fine sands in increasing the filtering rates. The amount of clay is the dominating factor in filtering rates, and this fact is indicated by the curves approaching a common point as the thickness of the cake is increased.

The marked increase in filtering rate, with moderately elevated temperatures, was so noticeable as to indicate a condition of considerable practical importance. By increasing the temperature of the pulp greater capacity could be readily obtained with a given unit.

Filtering Surfaces

Most of the suction filters employ No. 10 canvas duck for the filtering surface. The Oliver filter makes use of a No. 12 and the Merrill filter press of a No. 6 duck over a light twill. In the Butters and the Moore filters three methods of support are in common use. The original Butters unit consisted of canvas stitched at close intervals over a center sheet of cocoa matting, which gives a porous gathering space for the solutions and also sufficient support to the canvas. The objections to this construction are the cost, and the clogging of the matting. With the exception of the Goldfield Consolidated mill, all the mills in the Tonopah and Goldfield districts employ the "slat method" of support, which consists of sewing the canvas walls of the cell into narrow pockets from 1.5 to 2 in. wide, and into each of these slipping a grooved lath. The arrangement is low in first cost and satisfactory.

The Moore system employs wooden strips slipped into narrow pockets in the canvas. The Moore system also makes use of wire netting between the canvas walls, the canvas being stitched at frequent intervals through the netting. In the Oliver filter, wire netting over a grooved board and covered with 8-oz. burlap supports the canvas. The canvas is held against this base by wire wrapped around the canvas at 0.5-in. intervals. In both the Butters and the Moore filters wooden dividing strips are used to space the filtering surface into strips 1 ft. wide. Grooved iron plates are used in the filter presses and in the Merrill press.

Durability and permeability are the necessary requirements of a filtering cloth. Canvas duck, army weave, No. 10, answers both of these requirements for

suction filters. For pressure filters this canvas is too light, and No. 6 gives sufficient durability without interfering with the filtration too much. On account of the wire wrapping, the Oliver filter can employ a lighter duck (No. 12). The relative permeability of different weights of canvas is a difficult matter to determine experimentally. It is a function of the weave of the cloth and the character of the supporting surface. In general, the lighter the weight of the duck the more permeable it is. Duck may be obtained in three weaves: army duck, in which the threads of warp and woof are twisted; double fill, in which the warp thread is twisted and the woof threads are not twisted; single fill, in which neither the warp nor the woof threads are twisted. Of the three weaves the army duck is the least permeable, while the other two weaves are too open and porous to be of much use in slime filtration.

Numbered Duck	Ounce Duck 29 In. Wide and 36 In. Long	Ounces per Square Yard
	Ounces	
No. 12	8	10
No. 10	12	14—15
No. 8	15	18—19
No. 6	18	22—23

Experiments led to the general conclusion that the permeability of the filter cloth is a matter of moderate importance; of greater importance with the thin-cake suction filters than with the thick-cake filters. No experiments could be made on the comparative durability of filter cloths. From data collected it appears that suction filters, supported with cocoa matting, have the longest life. Close stitching is of importance both in maintaining an efficient filter and in prolonging the life of the filter cloth. The first Moore filters were constructed with the canvas supported at 6-in. intervals, and these filters failed by tearing and weakening generally at the points of attachment. With stitching at 1-in. intervals the wear at the stitching points is reduced materially in the Butters filter. With the slat filter narrow slats allow closer stitching, and this is the tendency in construction.

The grooved support results in practically a clear solution from the start of filtration, whether a No. 10 or a No. 12 duck is used. The diamond-strip support and No. 12 canvas gave a turbid filtrate for the first minute of filtration. The relation between numbered duck and ounce duck is shown in the accompanying table.

Character of Slime Cakes

A slime cake is built up of a succession of thin layers of slime. Slices taken from the surface, middle and next the canvas showed varying percentages of water, and consequently a variation in density from the outer surface to the canvas. Sections of slime cakes were studied. The cake was 0.81 in. thick, and the vacuum used 21 in. The outer 0.25 in. contained 41.4; the middle, 39.6; and the portion next the canvas, 33.3 per cent. of water. The respective specific gravities are 1.575, 1.605 and 1.715. The average water content is 38.1 per cent., and the average specific gravity, 1.632. The comparative results between sand and slime show that the percentage of water is no indication of the permeability of a porous material.

With one exception there was an increase in the specific gravity with an increase of pressure. This increase in the density of the cake means a decrease in the permeability, and therefore a decrease in filtering rate. A slime cake may be likened to a number of layers of rubber spheres. Pressures great enough to overcome the elasticity of the spheres would have the effect of squeezing them into spheroids and reducing the interstitial space; still greater pressures would cause the spheroids to encroach upon the open spaces until these would be practically closed and the interstitial space become zero. The difficulties involved in using high pressures upon slime carrying a minimum proportion of sand are apparent. The effect of the presence of sand would be the same as if angular grains were mixed with the rubber spheres. Under pressure the angular grains would press against one another and prevent any great degree of pressure coming upon the spheres. There would be a comparatively small decrease in the interstitial space, and therefore little or no reduction in permeability.

Cakes Shrink during Transfer

An interesting phenomenon was noticed in transferring slime cakes. The lifting of a cake from the pulp was accompanied by an immediate shrinkage in the thickness of the cake. The reduction in thickness amounted to from 10 to 12 per cent. On submerging the cake in the pulp the original thickness would be approximately resumed. The effect of the shrinkage is to increase the density and decrease the filtering rate. With sand-slime cakes no noticeable shrinkage was observed until the cake approximated a thickness of 1 in., and in all cases this shrinkage was less than that of the slime cake. During the building up of a slime cake there is a progressive densification, somewhat slow and often irregular, which accounts for the erratic results obtained in some cases with the filtering-rate experiments. The progressive densification of a slime cake may be shown in another way. Subjecting a thick slime cake to continued pressure when immersed in water, and determining the filtering rate at several successive time intervals, gives a slow drop in the filtering rate. Increase in temperature has a slight effect in increasing the density of the cake, but the experiments on this point were on the whole somewhat inconclusive.

Why Slime Cakes Crack

The cracking of a slime cake takes place under two conditions: when it is removed from the pulp and allowed to remain in the air under full pressure, and when removed from a pulp to water at a temperature 40 or 50 deg. C. higher than the pulp. The latter condition is of little practical importance. The former is overcome by reducing the vacuum pressure to just sufficient to hold the cake upon the cloth. Too long an exposure even at this pressure will cause a cake to crack. Under a vacuum pressure of 21 in. a 1-in. cake will break down in from 2 to 10 min. Sand-slime cakes will stand a longer exposure than slime cakes. The cause of cracking is lateral shrinkage, due to the displacement of the water by air and air drying.

In building up cakes with vertically suspended filtering cells there is a tendency for the cake to build up thicker at the lower end. This is due to the increase of filtering pressure due to increased hydrostatic head, and also to the thickening of the slime pulp in the lower part of the filter vat. Agitation will prevent, to a large extent, the building up of thick-ended cakes. Where the proportion of sand is large and the sand grains are coarse, agitation is quite necessary, but should not be too vigorous, as otherwise the building up of a cake would be seriously interfered with by erosion. With fine sands, finer than 200-mesh screen, if a pulp density of 1.4 or more is maintained, little or no trouble is experienced by the sands settling out. Apparently the pulp, in the experiments, remained quite homogeneous for intervals of longer than one hour. With a greater proportion of water in the pulp moderate agitation is necessary in most cases.

Slime cakes should be built up with vacuum pressures as constant as possible, and should be kept completely submerged while the cake is forming. The temperature of the pulp and of the wash water should be the same. Transfers from pulp to wash should be made as rapidly as possible and under reduced pressures. Filters in which the transfers are quickly made, and with the minimum of exposure of the cake to the air, are more efficient and maintain a higher filtering rate than those in which long time intervals are required for the necessary transfers.

Building Up Slime Cakes

Three direct factors control the rate of and the total time required for building up the cake; the thickness of the cake, the filtering rate of the slime, and the proportion of water in the pulp. Indirectly, temperature, viscosity of the pulp, intensity of the vacuum used, depth of

submersion of the cell, agitation, and the physical character of the slime, play a part in the building up of the cake. The effect of the indirect factors is summed up in the filtering rate.

Practical experience has placed certain well defined limits upon the thickness of the slime cake. For example, the Ridgway filter utilizes a thickness of from 0.125 to 0.375 in.; the Oliver, from 0.25 to 0.5; the Butters and Moore, from 0.75 to 1.75; the Merrill, from 1.75 to 2; the Kelly, from 1 to 3, and the Burt revolving filter, up to 6 in. With vertically suspended filters the thick cakes tend to tear apart and drop during the transfers. The thickness of the cake also determines the time required for washing. Thick cakes require relatively a much longer time to wash than the thin, on account of the low filtering rates, and the capacity of a filtering unit may be greatly cut down. With slime cakes the lower limits mentioned above are used; with sand-slime cakes the upper limits may be used.

Other things being equal, the less solution that is required to be drawn through a filter in the building up of the cake the more quickly the cake will be secured, and consequently it is desirable to have the slime pulp as low in content of water as possible. There is a practical limit to the thickening of the slime pulp, and this is established by the settling power of the pulp and the fluidity of the settled pulp. The settled pulp must be handled in pipes and with centrifugal pumps, and if it is too thick it becomes impossible to do this. A thick pulp is advantageous where much sand is to be held in suspension. In Nevada, with quartzose ores, pulp ratios of from 3 of solution to 1 of slime down to 1.5 of solution to 1 of slime are in use. The average pulp in use is 2 of solution to 1 of slime.

Experiments show that as a slime cake builds up a slow consolidation takes place, and superimposed upon this is an irregular and faster rate of consolidation. The irregular consolidation is characteristic of exceedingly slimy and clayey slimes, and becomes less so as the proportion of sand is increased. The sand diminishes the elastic nature of the slime cake.

Washing

A slime cake retains from 28 to 38 per cent. of solution; the former for sand-slime and the latter for slime cakes. Were it not for osmosis, simple displacement with a volume of water equal to that retained by the cake would be sufficient to remove the dissolved salts of gold, silver and cyanide. As it is, the soluble salts diffuse back into the wash water, and in time this builds up in gold and silver to such an extent that an appreciable loss results when, as in the Butters filter, the slime cake is flushed out with the residual wash water. By the use of two separate wash solutions this difficulty can be more or less overcome; but it has the objection that an additional pumping of solution and exposure of the slime cake to the air are necessitated. With the Moore, Oliver, and the pressure filters generally, no great trouble is experienced from loss of precious metals in the wash solution, for in each case only that wash water which is left in the cake after air displacement takes place is discharged, and this amounts to from 20 to 30 per cent. In practice it is customary to use barren solution or wash water in amount equal to from one to three times the amount of solution retained by the cake. With extremely low-grade solutions the former, and with high-grade solutions the latter, would be used. Twice the weight of the solution retained by the cake is usually sufficient to displace the gold and silver retained by the solution in the cake. The thoroughness of washing is determined largely by the expense. When the value of the gold, silver and cyanide recovered is less than the cost of recovery, washing stops.

It seems to me that with the thin-cake filtering appliances a smaller proportion of wash water would be required than for the thick-cake filters, for the reason that the rate of filtration is much higher with the former. Strength of solution, time, and temperature, are the controlling factors in osmosis; and of these, time is perhaps the most important; for the other two would be the same in either case. The shortness of the time required for washing and the relatively high filtering rate in the case of the Oliver filter would give little opportunity for osmosis to interfere with the washing.

No washing experiments were made with suction filters. A few experiments were made with a pressure filter in washing slime cakes containing cyanide solutions. With pressures varying from 20 to 30 lb., and with a 0.2-per cent. cyanide solution, a 0.75-in. cake required from 1.3 to 1.4 times the contained water to reduce the cyanide content to 0.02 per cent.

Conclusions

Certain practical conclusions may be drawn from the experimental work. These have been in part stated, but may not be out of place here, together with certain general conclusions which are not so directly shown by the experimental work. They are:

(1) The proportion of clayey material in ores which are to be subjected to "all sliming" and filtration should be maintained at a minimum.

(2) The slime pulp should be as free as possible from sands coarser than a 150-mesh screen, and as large a proportion of the pulp as possible should consist of material passing 200-mesh.

(3) The slime pulp before filtration should be settled to as thick a consistency as possible consistent with ready handling by pumps and in pipes.

(4) The temperature of the slime pulp should be maintained between 20 and 30 deg. C. or higher.

(5) The temperature of the wash water and the pulp should be the same.

(6) Vacuum pressures should be varied until the proper intensity for the given slime is obtained.

(7) Where exceedingly clayey slime is to be filtered, as much fine sand (limited as stated above) should be crowded into the pulp as it will carry without undue settling and clogging.

(8) No. 10 canvas supported by slats gives the best all-round service for the thick cake, and No. 12 canvas on wire netting answers the requirements for the thin-cake filtering machines.

(9) With slimes containing a large proportion of colloid or clayey material pressures greater than those obtainable with vacuum apparatus are of questionable advantage.

(10) With slimes containing a large proportion of clayey material the vacuum filters should be used.

(11) With slimes containing a small proportion of clayey material and much fine sand both vacuum filters and pressure filters could be used with perhaps equally good results.

(12) With slimes containing much coarse and fine sand the chamber filters with air agitation and high pressures would perhaps give the best results.

(13) Of the vacuum filters, the thin-cake continuous filters are a decided improvement over the thick-cake filters.

Mining Academy at Przibram May Be Moved

Jena Correspondence

The silver mines at Przibram, belonging to the Austrian state, are near exhaustion and, having been worked at a loss for a number of years, the authorities in control have decided to shut them down for good, according to one of the technical journals. This decision will have to be carried out gradually, as the government must find employment for the 2000 or more workmen who are thus to be let out. This will be the death blow to the mining town of Birkenberg, a suburb of Przibram, where most of the mine workers live. In this connection the question of transferring the mining academy of Przibram, which has been under consideration for some time, to a German-speaking town of Bohemia, will be settled finally, and it is creditably reported that the town of Brüx, the center of extensive lignite-mining operations, has been selected as the future seat of the academy.

Rich deposits of lead ore have been discovered in the district of Opatow, department of Radom, Russian Poland.

Oriental Consolidated Mining Co.

The report of the Oriental Consolidated Mining Company for the year ended June 30, 1911, presents detailed information concerning the operation of that company in the Wunsan district of Chosen. The holdings of the company cover an area of about 500 square miles in northern Chosen. As shown in the accompanying sketch map, the mines are widely scattered over the concession. The scope of the enterprise is indicated by the fact that the company is operating seven mines, five concentrating mills, three cyaniding plants, one dump-retreatment plant, well equipped shops, hydroelectric plant, cordwood railway, fleet of three schooners and an efficient hospital.

Last year the seven mines of the Oriental Consolidated in Chosen (Korea) produced 344,097 tons of ore averaging $5.19 per ton in gold, obtaining a net profit of $672,720 or $1.96 per ton. Five mills using 240 stamps yielded $2.68 per ton by amalgamation; and three cyanide plants treating the concentrates yielded $1.69 per ton.

NOTE—Abstract of annual report of the Oriental Consolidated Mining Company, 15 Broad street, New York.

OPERATING RESULTS

The report of the general manager shows total receipts for the year of $1,541,346, and operating costs of $839,858, leaving a total operating profit of $701,488. Of this last sum $28,768 was put back into new construction, development work, etc., which left $672,720 as the net receipts over all expenditures for the year. The average value of the ore was again lower than during the previous year. An increase of $49,043 in net profit was shown, however, due to larger tonnage, smaller expenses of development of outside mines and an increase of 3.4 per cent. in net saving in milling and cyaniding. The costs for the year are as follows: Mining, $1.41; milling, 56c.; concentrate expenses, 15c.; transportation of ore, 1c.; general expenses, 32c.; total operating and general expenses, $2.45 per ton. Development of outside mines and construction expenses bring the total up to $2.53 per ton.

COST OF MINING LOW

The production of the mines for the year is shown in the accompanying table. It is worthy of notice that the cost of mining was kept at the low figure of $1.41 per ton, although the mines are getting deeper and the cost of fuel has increased.

The Tabowie shaft was sunk 127 ft. and is now about 70 ft. below No. 10 level, a total depth of 1228 ft. The Taracol shaft was sunk 172 ft. and is now about 50 ft. below No. 10 level.

PRODUCTION OF ORIENTAL CONSOLIDATED MINES FOR YEAR ENDED JUNE 30, 1911

	Produced, Tons	Value per Ton	Cost per Ton
Tabowie	121,257	$5.07	$1.26
Taracol	85,062	4.92	1.59
Chintui	29,637	5.02	1.41
Kuk San Dong North	28,659	3.09	0.72
Kuk San Dong South	29,734	2.54	0.65
Charabowie mine	39,610	8.38	1.77
Candlestick mine	8,997	10.90	4.80
Total ore mined by company	342,956	$5.17	$1.41
Tribute mines produced	1,141	9.77	....
Total mining operations	344,097	$5.19	$1.41

The Charabowie mine is exceedingly wet, the cost of pumping being the largest item of expense. Two pumps had to be added during the year and as some of the pumps are more than 1800 ft. distant from the steam plant on the surface, much power is lost through condensation. Since the mine cannot be developed further with the present equipment an extra boiler and an air compressor will be installed this year.

ORE RESERVES NEARLY 400,000 TONS

Development work to the extent of 23,037 ft. was done during the year. The ore reserves on July 1, 1911, were estimated at 392,280 tons. The mines show an increase in ore reserves, except in the cases of the Chintui and Kuk San Dong mines, which appear now to be nearly exhausted. These mines show a reduction of about $200,000 in value of reserves, while the other mines show a gain of over $100,000.

The milling record for the year is shown in an accompanying table. As indicated, $921,731 was secured in the stamp batteries by amalgamation. By concentration 36,578 tons were saved, having a gross value of $695,880 while the table tailing having a value of $170,017 went to waste. The concentrates yielded by cyanidation $581,997. The concentrates after treatment are stacked so as to be available for retreatment later.

The cost of treatment at the Taracol cyanide plant was 2½c. per ton higher than in the previous year, but the extraction of 86 per cent. was the best ever made. During the coming year tube mills and agitators will be installed to treat the Tabowie and Taracol fresh concentrates. The extraction of 66.8 per cent. at the Kuk San Dong cyanide plant was 2.8 per cent. higher than last year, and the cost of treatment 27½c. per ton lower. At the Candlestick cyanide

TABOWIE CAMP OF THE ORIENTAL CONSOLIDATED, CHOSEN

plant the extraction was 53.7 per cent.; the cost of treatment, $1.06 per ton.

Bullion amounting to $1,503,729 was sent to the Imperial Japanese mint at Osaka, at a cost of $5958. The bullion was sent over the government railways and was handled by the Bank of Chosen, Limited.

All the concentrate which has been treated in the company's cyanide plants since they started has been stacked, and on July 1, 1911, there were 197,879 tons, worth $895,767, on the dumps. Floods and winds have carried off a considerable portion of these dumps. Accordingly a reduction in the old figures had to be made, and the above estimates are based on the contents of the dumps at the present time.

New Retreatment Mill

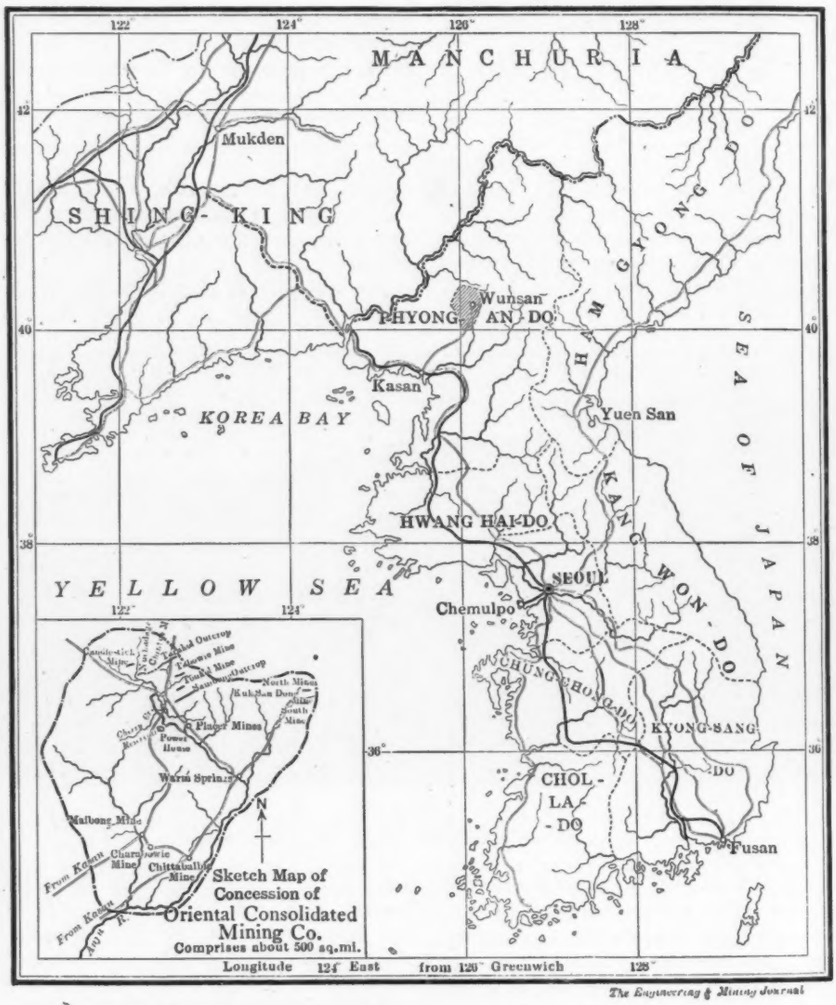
During the year a plant was installed at Kuk San Dong to treat the dump there. The plant was designed and erected by the metallurgist, A. E. Drucker. The method of treatment consists of washing the material as it comes from the dump in a revolving-screen washer, classifying in hydraulic cone classifiers and reconcentrating on Wilfley tables. The tails from the concentrator plant are rejected, while the concentrate obtained, containing the bulk of the gold, is classified, reground (all-slimed) in a tube mill, agitated in Pachuca tanks, filtered in a Dehne 24-frame press and the gold precipitated in zinc boxes. Up to Aug. 1, 1911, the plant had an irregular run, due chiefly to troubles with the sand pumps, Pachuca agitators, steam engines and inexperienced help.

The Pachuca agitators were connected in series and fitted with baffle cylinders, so as to use the continuous agitation and decantation method so successfully applied in Mexico. The arrangement proved a failure in this mill, however, and it was impossible even to obtain a satisfactory circulation of the pulp, or clear solutions to the clarifier tanks and zinc boxes. This proved a serious trouble and prevented putting through a satisfactory amount of concentrates, and interfered largely with the precipitation. These defects have been overcome by a different arrangement.

The plant is now treating 60 tons per day, and will be brought up to 80 tons capacity, as was originally intended. In order to prevent losses until things were made right, ore assaying only $2.56 per ton was run through the mill. The average value for the total dump is about $7 per ton. The new plant at Taracol will reap the benefit of the experience at Kuk San Dong. The results so far obtained are as follows: Dump heads, $2.56 per ton; gold extracted by concentration, 79 per cent.; gold extracted from concentrates by cyanidation, 73 per cent.; total bullion extraction, 58 per cent.

The sum of $1871 was expended in erecting the Maibong canvas plant which is in successful operation. At the Tabowie and Kuk San Dong assay offices during the year 32,843 assays were made at a cost of $5397. This total expense included the cost of melting all the bullion except the Taracol cyanide plant's bullion.

The Taracol shop is a highly important department and comprises foundry, blacksmith shop, machine shop, saw and planing mills. Most of the equipment for the Kuk San Dong dump retreatment plant was built here. Two hoisting engines and four large pumps were also manufactured at these shops.



Map of Chosen, Showing Concession of Oriental Consolidated

At the company's hospital at Taracol 19,209 cases were treated during the year; 8776 cases out of the above number were company employees. No charge of any kind is made at the hospital, and the people come from far and near to avail themselves of this free medical service.

Bonus Distributed at Christmas

On Christmas day, 1910, $10,000 was distributed among the white employees on a percentage basis, the older employees receiving the greater benefit. This is the sixth consecutive Christmas that $10,000 has been distributed.

The electric water-power plant ran 194 days during the year. The plant lost 69 days due to shortage of water and 102 days owing to a fire, which destroyed the power house and parts of the machinery on March 17, 1911. The efficiency of the water-power plant was higher than ever before, due to various mechanical improvements made throughout the electric-power department, and to the improved saving of the water. The operating expenses of the electric-power plant for the year were $14,614; this includes all expenses to date on the new 4400-ft. ditch from Nuchadagi to Hannahbul Junction. The rainfall for the year was 60⅓ in., more than half of which came in July and August.

About $30,000 was expended during the year on the cordwood railways and for timber-land taxes, but all of these expenses were charged to the wood company, which, in turn, reimbursed itself by selling cordwood, timber and lumber to the mines and mills at an increased cost. The Chosen district cordwood rail-

way was extended one mile, making a total length of 14 miles. An inclined tramway, 4300 ft. long, connecting the Chosen and Unsan district railways, was completed during the year and is running successfully. It has brought about a material saving in the cost of handling wood and timbers. The cordwood company handled about 16,200 cords of wood and about 38,000 mining timbers during the year for the Tabowie and Taracol camps.

Reforestration Compulsory

In the last annual report it was stated that a settlement had been reached with the government authorities respecting the wood and timber supply. Under this arrangement the principle seemed to be established that mining enterprises requiring timber should be permitted to procure it under the condition that they pay a tax, which would be expended in the reforestration of the denuded area; and it was agreed that the Oriental Consolidated should pay a yearly sum of 25,000 yen as a reforestration tax. The company's officers are quite in sympathy with the government officials in their desire to protect the forests of the country; the use of timber and wood is of vital necessity if the mines are to be operated. In view of the friendly attitude heretofore of the Japanese authorities, President H. C. Perkins is confident that some method will be found, which, while protecting the forests as far as possible, will enable the company to pursue its operations without being called upon to submit to harassing regulations or unduly onerous taxation.

It is interesting to note that about $300,000 worth of supplies are kept in stock. Out of the list the following have been selected: 69,550 lb. of cyanide; 107,843 lb. of lime; 78,650 lb. of zinc and zinc dust; 518,400 ft. of fuse; 30,868 lb. of dynamite; 299,000 detonators; 663 stamp shoes; 370 dies, and $19,140 worth of candles.

The officers of the company are: H. C. Perkins, president; Leigh Hunt, vice-president; Alfred Welhaven, general manager; Thomas W. Van Ess, auditor; E. S. Barstow, superintendent of transportation; G. M. Ford, superintendent of Tabowie and Taracol camps; H. P. Civretto, superintendent of Maibong and Kuk San Dong camps; J. B. Lower, superintendent of Candlestick, Chintui and prospects; A. E. Drucker, metallurgist.

Kuk San Dong Retreatment Plant of Oriental Consolidated

Resources of Katanga, Africa

British Vice-consul Beak reports that the boundaries of what is commonly known as Katanga province, Africa, are as follows: North, fifth parallel south; east, Lake Tanganyika; south, northern Rhodesia; west, the river Sankuru. The southern portion of Katanga, in which are situated copper and tin belts, is a high plateau of 5000 ft. and upward above sea level, where whites can thrive. The conditions of life are rough, but until recently, on the information available, the death-rate in the mining area was kept low. For instance, out of an average of 30 Europeans employed by the Tanganyika Concessions, Ltd., between 1902 and 1909, only one man died in the country, representing a death rate of less than 5 per 1000 per annum.

The copper mines of Katanga are old, the natives having worked them for centuries. The southern copper belt extends for a distance of 200 miles, with a breadth of from 35 to 60 miles, or at least 7000 square miles of country, in which valuable minerals have been proved.

There are also isolated deposits outside this belt, which are believed to belong to the same group as Bwana M'Kubwa and Kansanshi, in northwestern Rhodesia. More recently copper mines have been opened in the neighborhood of Vundaviabo, Kilwa and in the valley of the Lushinda.

Of the tin area less is known, but at one place an area of 1,125,000 square yards has been proved and much of this contains about 50 lb. of tinstone per cubic yard. The tin belt lies north of the copper deposits, and extends in an almost parallel line with the copper area for a distance of 100 miles. Gold has been profitably worked at Ruwe and discovered at Kowa, Kafumasabo, and near the Star of the Congo.

The search for diamonds has been partially successful, as some stones have been discovered on the West Lualabo, and on the Kundelungu diamond pipes are known to exist and are being examined. Both of these areas have recently been reserved, and sufficient inducement exists for the company to prospect further for both diamonds, and coal which has not yet been found in workable quantities.

MILLING RECORD OF ORIENTAL CONSOLIDATED FOR YEAR ENDED JUNE 30, 1911

Name of Mill	Number of Stamps	Tons Ore Crushed	Stamp Duty for 24 Hours, Tons	Value of Ore Crushed	Value Ore per Ton	Bullion Secured	Gross Value Concentrate Saved	Tons Concentrate Saved	Bullion Secured from Concentrate	Value Tailings
Tabowie	80	121,257	4.4	$614,603.17	$5.07	$273,318.86	$283,953.32	11,335	$245,321.17	$57,330.99
Taracol	80	115,840	4.3	578,727.96	4.99	269,277.00	262,196.27	11,561	227,884.04	47,254.69
Kuk San Dong	40	58,393	4.2	164,081.09	2.81	97,663.27	51,132.75	5,491	34,194.06	15,285.07
Maibong	30	39,610	3.8	332,122.28	8.38	208,213.72	75,565.75	897	62,042.21	48,342.81
Candlestick	10	8,997	2.9	98,094.20	10.90	73,258.24	23,032.13	7,294	12,556.04	1,803.83
Total	240	344,097	4.2	$1,787,628.70	$5.19	$921,731.09	$695,880.22	36,578	$581,997.52	$170,017.39

The Steel Corporation Suit

Suit was filed against the United States Steel Corporation in the United States Circuit Court at Trenton, N. J., Oct. 26, by the attorney general. The beginning of the proceedings was unexpected. It was not known outside the Department of Justice that complaint had been prepared, and it has been quite a common belief that recent action of the Steel Corporation, in reducing rates on its Minnesota railroads and in preparing to surrender the Great Northern ore-land leases, had gone far toward relieving it from prosecution under the Sherman law. It seems, however, that the Department of Justice held—largely on authority of the report recently made by the Bureau of Corporations—that it was necessary to hold the Corporation as a conspicuous offender and to make its case a supreme test of the law.

The Government seeks to dissolve the Steel Corporation as in violation of the Sherman law, and as a combination in restraint of trade. Specifications of the complaint.

The Defendants

The complaint names the following individuals as defendants: J. Pierpont Morgan, John D. Rockefeller, Andrew Carnegie, Charles M. Schwab, George W. Perkins, E. H. Gary, John D. Rockefeller, Jr., Henry C. Frick, Charles Steele, James Gayley, William H. Moore, J. H. Moore, Edmund C. Converse, Percival Roberts, Jr., Daniel G. Reid, Norman B. Ream, P. A. B. Widener and William P. Palmer.

The corporate defendants are the United States Steel Corporation, Carnegie Steel Company, Carnegie Company of New Jersey, Federal Steel Company, National Steel Company, American Steel and Wire Company of New Jersey, National Tube Company, Shelby Tube Company, American Tin Plate Company, American Sheet and Tin Plate Company, American Sheet Steel Company, American Steel Hoop Company, American Bridge Company, Lake Superior Consolidated Iron Mines, all of which were organized under the New Jersey laws; and the H. C. Frick Coke Company, the Tennessee Coal, Iron and Railroad Company and the Great Western Mining Company.

In addition there are named as parties to the suit the trustees of the Great Northern ore lands; the Union Steel Company, Clairton Steel Company, West Mesaba Land Company, Ltd.; Wright Land Company, Ltd.; Davis Land Company, Ltd.; Wells Land Company, Ltd.; Stone Land Company, Ltd.; Wabigon Iron Company, Minosin Iron Company, Nibiwa Iron Company, Wenona Iron Company, Minawa Iron Company, Leonard Iron Mining Company, Arthur Iron Mining Company, Fillmore Iron Mining Company, Harrison Iron Mining Company, Jackson Iron Mining Company, Polk Iron Mining Company, Tyler Iron Mining Company, and the Van Buren Iron Mining Company.

The Complaint

The complaint is of great length, rehearsing the history of the Steel Corporation and the various combinations and consolidations of 1897-1901, which preceded its formation and led to the organization of various consolidated companies which were later absorbed by the Corporation. Various charges are made against several of these constituent companies. Much of this part of the complaint is very similar to the report of the Bureau of Corporations, and the testimony taken by the Stanley committee, a summary of which has heretofore been published.

The Tennessee Purchase

The complaint goes at length into the circumstances attending the purchase of Tennessee Coal, Iron and Railroad Company in 1907; following in this also the Bureau of Corporations reports and also the testimony given before the Stanley committee of the House of Representatives. It charges that the sale was forced, owing to the control of certain parties over the money market at the time; and that it removed from competition with the Steel Corporation a rival which might have become a formidable one. In this connection it is charged that President Roosevelt's supposed consent to the purchase was obtained by misleading statements. It is charged that the purpose of acquiring the Tennessee company had been previously formed, and that advantage was taken of financial conditions to carry it out.

Control of Iron Ores

Attention is called to the great ore reserves of the Tennessee company as a controlling interest in its purchase. Further attention is called to the lease of the Great Northern ore lands. This is made a strong point in the complaint, which charges that the southern acquisition and especially the Hill lease were intended to prevent competition. As to the lease the statement is made that "the purpose and effect of said lease were to shut off competition by preventing the establishment of a competitor; to secure an undue power over the steel business by controlling the source of supply of ore by taking it out of the market, and to restrain trade and commerce and a monopolization within the meaning of the anti-trust act."

Then the petition says: "The petitioner has been informed by the Corporation that its finance committee on Oct. 17, 1911, unanimously decided to cancel said lease. However, under the terms of said lease, no such cancelation can take effect before Jan. 1, 1915, and there is no limitation upon the amount of ore that can in the meantime be taken out by the Corporation."

Transportation

Under this head the complaint says: "The profits derived by the Corporation from its transportation properties, chiefly railroad lines, represent a large part of its earnings, and these are largely derived from the rates and tolls imposed by the Corporation upon other steel manufacturers, who have to have their ore transported in the Minnesota ore region by the Duluth & Iron Range and the Duluth & Missabe railroads. By the power thus acquired a burden is imposed upon competitors and a restraint is thereby exercised upon trade and commerce between the States. Since 1904 the Duluth & Iron Range Railroad Company has paid dividends upon the capital which have averaged more than 100 per cent. per annum. For the same period those of the Duluth, Missabe & Northern Railway Company have been from 102 per cent. to 240 per cent. per annum upon the capital stock. Petitioner has recently received information of the purpose of the Corporation to reduce the rates of these roads 10 or 20 cents per ton.

"Through the ownership of the Elgin, Joliet & Eastern Railway, and more particularly through the Bessemer & Lake Erie, the Corporation has a further important advantage over most of its competitors with respect to transportation. Its minor railroad properties, particularly the Union Railroad of Pittsburg, the Chicago, Lake Shore & Eastern railway, the Connellsville & Monongahela railway and that of the Tennessee company, are important factors in its transportation system, and give it an advantage over its competitors."

Combination to Suppress Competition

Finally the complaint refers at much length to the various meetings of the steel trade called at Judge Gary's instance, and their effect in controlling prices of steel products. The complaint says: "Under the auspices of the corporation these interests, naturally competitive but harmonized by the network of correlations and overshadowed and dom-

inated by the power of the Corporation arising from its preëminence in the business, and the irresistible strength of its alliances, come together from time to time, find out the views of the Corporation in respect of prices and output and all that hitherto was effected by pools and formal agreements, reach a common understanding and purpose and proceed to carry them out. It is not here alleged that merely assembling and mutually exchanging information and declaration of purpose amount to an agreement or combinations in restraint of trade. These meetings and their results have gone further. What they actually accomplished shows the great and dangerous power achieved by the Corporation through unlawful combination exercised over the trade and commerce of the country. The concerted action taken has prevented fluctuations in prices and competition.

"At the meetings have been represented of the iron and steel trade in the United States fully 90 per cent. of the total. In no line of business in the world at any time has there been such a large percentage of those engaged in a business as the percentage of those in this country who at these meetings go along day by day, hand in hand, pursuing the same course."

Various instances are given of the action resulting from these meetings, and the charges are summed up as follows: "By the aforesaid pools, agreements, meetings and acts of coöperation, the said several companies and individual defendants, in addition to the several unlawful agreements and combinations by which all of the companies and properties aforesaid were brought under one control, have combined or conspired in restraint of trade and commerce among the several States and with foreign nations within the meaning of Section 1, and to monopolize a part of the trade or commerce among the several States and with foreign nations within the meaning of Section 1, and to monopolize a part of the trade or commerce among the several States and with foreign nations within the meaning of Section 2 of the anti-trust act."

The Relief Asked

In closing its complaint the Government submits to the court the following petition: "In consideration whereof, and inasmuch as adequate remedy in the premises can only be obtained in a court of equity, the United States of America prays your honors:

"1. To order, adjudge and decree that the combinations and conspiracies and monopolization of trade and commerce herein before described are unlawful, and that all acts done or to be done to carry out the same, or any part thereof, are in violation of the act of Congress of July 2, 1890, entitled 'An act to protect trade and commerce against unlawful restraints and monopolies.'

"2. That the defendants and each and every one of them and the officers, directors, stockholders and agents of the defendant corporations and of each and every one of them be perpetually enjoined from doing any act in pursuance of or for the purpose of carrying out the same.

"3. That the United States Steel Corporation in and of itself as well as each and all of the elements composing it, whether separate or individual, whether considered collectively or separately, be decreed to be illegal and in restraint of trade, and an attempt to monopolize and a monopolization within the first and second sections of said act of Congress of July 2, 1890, and that it be dissolved.

"4. That each and all of the said constituent or subordinate companies shown, as aforesaid, to have been combined in restraint of trade and commerce and in monopolization of trade or commerce within the meaning of the anti-trust act, each in and of itself, as well as each and all the elements composing each respectively, whether considered collectively or separately, be decreed to be illegal, in restraint of trade, and an attempt to monopolize and a monopolization within the first and second sections of said act, and that each be dissolved.

"5. That the holding of stock by any one of the defendant corporations in another of the defendant corporations under the circumstances shown be declared illegal, and that each of them be enjoined from continuing to hold or own such shares and from exercising any right in connection therewith.

"6. That the said several defendant corporations, shown as aforesaid to be constituents or subsidiaries of the United States Steel Corporation, be enjoined and prohibited from declaring or paying any dividends to the said United States Steel Corporation or to any person or corporation for its use.

"7. That it be decreed that the several individual defendants combined each with other persons and corporations to restrain trade and commerce and to attempt to monopolize and in monopolizing within the first and second sections of said act and that each of them be enjoined from continuing to carry out the purposes of any of the above described combinations and conspiracies and attempt to restrain commerce and trade, or to monopolize any part of commerce and trade among the States and with foreign nations.

"8. That such orders and decrees be made in respect of the stock issued under the several combinations aforesaid as shall be in accordance with equity and good conscience, and that such disposition be made of the said various properties as shall effectuate the purposes of the said anti-trust act.

"9. That the said lease entered into as aforesaid by the Great Northern interests and the Great Western Mining Company be decreed to be illegal, in restraint of trade and commerce, an attempt to monopolize and a monopolization within the first and second sections of said act, and that the same be now canceled.

"10. The United States also prays for such other and further relief as the nature of the case may require and the court may deem proper in the premises.

"To the end, therefore, that the United States of America may obtain the relief to which it is justly entitled in the premises, may it please your honors to grant to it writs of subpoena directed to the said defendants."

Action of the Corporation

At a meeting of the board held Oct. 26—before the suit was instituted—the directors voted unanimously to give notice of the cancelation of the Hill ore leases, and to approve the reduction of freight rates on the Minnesota railroads owned. On the day after the filing of the complaints the following statement was given out by Judge Gary, head of the Corporation.

"I think it would be improper for me at this time to make any comments concerning the suit, which has been brought by the Government against the United States Steel Corporation, except to say I regret exceedingly that the Department of Justice felt called upon to institute proceedings. If any harm results it will fall upon the stockholders and employees, aggregating a very large number, and any loss to them must be deplored. It is a time for every one to keep cool, with a disposition to patiently await results, knowing that in the end justice will be done to all interests.

"I believe a disclosure of all the facts applicable to the allegations contained in the Government's bill of complaint as a ground for relief will show that the suit ought to be decided in favor of the corporation on the merits, and that the following facts will be established:

"(1) That in the organization of the United States Steel Corporation those in charge had no intention of creating a monopoly or of restraining trade.

"(2) That the corporation has never had or attempted to exercise a monopoly or to restrain trade.

"(3) That the conduct of the affairs of the corporation has clearly and positively negatived any effort or intention to violate any provision of the Sherman law.

"(4) That the existence of the corporation has been of benefit and not of injury to its employees, its customers, its competitors, and the general public.

"(5) That no misrepresentation was made to the President relative to the Tennessee Coal and Iron properties, and that the motive of those connected with the purchase was to prevent a threatened general financial disaster, which would have adversely affected the corporation as well as others."

First Aid to Mining Machinery—IV

By Henry M. Lane*

Description of the methods of making three-part molds, castings without complete patterns, and the sundry washes, peeling and facing mixtures used by foundrymen to obtain smooth-surface castings.

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The work described in the previous articles under this title has either been cast in open-sand or in two-part molds. Frequently castings are of such a form that it is necessary to resort to three-part molds or molds containing more than three parts. A good example of this type of castings is the small sheave wheel shown in Fig. 1. Guide wheels of this kind are used in slopes and for supporting ropes in horizontal drifts. A pattern of this kind must be of the split-pattern type, as otherwise it would be impossible to remove the pattern from the mold without disturbing the sand in the groove. It is possible to cast a sheave in a two-part mold by forming the groove with cores and in this case the pattern is made with the core print extended clear around the outer edge and a suitable core box made to produce a core equal to about one-sixth or less of the circumference of the sheave.

Making Three-part Molds

When making the sheave entirely in green sand, the pattern shown in Fig. 2 must be constructed. This is built of segments and turned or worked out to the desired form. In molding, the half of the sheave which carries the pin holes is placed on the molding board as shown in Fig 3. A narrow frame equal to about half the width of the sheave is placed in position around the edge as shown at *A A*, and the drag flask placed on top, as shown at *B*. The drag is rammed in the usual manner, the bottom board clamped in place, and the whole rolled over. The molding board and frame *A A* are removed and a parting formed from the edge of the sheave to the edge of the drag. An intermediate part, as it is called, is then placed on the drag *B*, as shown at *C*, Fig. 4. The second half of the pattern is placed in position, parting sand sprinkled over the face of the parting, and the body of sand *D D*, rammed into the groove about the pattern. A second parting is formed opposite the upper edge of the rim and the drag flask placed in position. Parting sand is then sprinkled over all the sand faces exposed, a sprue pin set on the hub of the pattern, and the cope portion of the mold rammed and struck off as shown. To remove the pattern the cope is lifted off and the upper half of the pattern *E* withdrawn. The practice from this point on varies.

In some cases the intermediate part *C* is next lifted off and the second half of the pattern drawn, after which the intermediate part is returned, the hub core set and the cope closed in position, ready for pouring. In other cases, after drawing the first half of the pattern *E*, the cope is closed on the mold once more, the bottom board placed in position, the mold rolled over and the drag *B* lifted off. The other half of the pattern *F* is then drawn, the hub core set, the drag returned and the mold rolled back into position ready for pouring. The reason for this latter method is that the narrow body of sand in the intermediate part *C* is difficult to lift without its falling.

When a three-part flask like that shown in Fig. 4 is not available, the three-part mold is sometimes made in a two-part flask, as shown in Fig. 5. To accomplish this, the drag half of the pattern *F* is first placed on the mold and the drag rammed. The drag is then rolled over and the sand around the edges of the flask cleaned out so as to form an inclined surface terminating at the edge of the lower flange. The cope half of the pattern *E* is then placed in position, parting sand sprinkled over the face of the mold, and a body of sand *D D* rammed or tucked in around the outer edge of the sheave so as to fill the groove. The upper face is smoothed and parting sand sprinkled over it, after which the cope flask *G* is placed in position, filled with sand and rammed.

To remove the pattern from the mold in this case only one procedure is possible, and that is as follows: The cope is lifted off and the cope half of the pattern *E* is drawn. The cope is then returned to the mold and the mold rolled over. This leaves the body of sand *D* resting on the cope so that when the drag flask *B* which is now uppermost, is lifted off, the portion of the pattern *F* may be withdrawn. After drawing the half of the pattern *F* the drag is returned to place and the mold rolled back so as to bring the cope uppermost. The cope is then lifted off, the core for the hub placed in position, the cope closed into place, and the mold is ready for pouring. The core for the hub for this pattern may be made in the half-core box, such as has been shown in one of the previous articles. There is a large variety of irregular castings which require three- or four-part molds, but

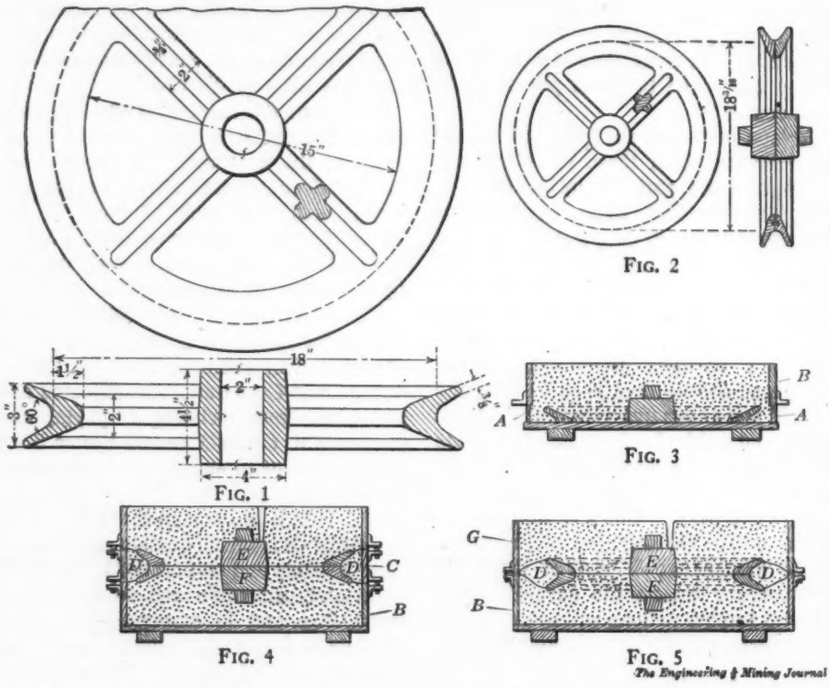

Fig. 1 Fig. 2 Fig. 3 Fig. 4 Fig. 5

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Patterns and Molds for Casting a Sheave

the principles involved are the same as those shown, and each case can easily be worked out from the general principles set forth in this article.

Hints in Connection with Foundry Work

Before closing a mold be sure that there is a sprue hole through the cope and the gate cut from the bottom of the sprue to the mold cavity, so that the metal can enter the mold freely.

Before starting to ram the cope part of a mold be sure that parting sand has been sprinkled over all of the exposed faces of the drag.

Before shoveling sand into the cope be sure that the sprue pin has been set in place.

Before rolling the mold over be sure that the molding boards are clamped firmly in place.

Before pouring a mold see that it is set level and firm on the floor and that the cope is weighted down or firmly clamped to the drag.

If in molding it becomes necessary to carry sand in fairly deep pockets, hooked-shaped pieces of iron wire made of rod iron, called by the foundryman "gaggers," may be used. These are bent into the form of hooks, dipped in clay wash and placed in the sand as the molds are being rammed.

In making a pattern the difficulty of calculating shrink may be avoided by using a shrink rule. A shrink rule for gray iron is made by taking a strip of wood or metal 12⅛ in. long, dividing it into 12 equal parts, and calling each 1 in., subdividing these into eighths or sixteenths as the case may require. Shrink rules may be obtained from any of the standard foundry-supply houses and by using them in the construction of patterns, mistakes are avoided.

Shellac is the best varnish for finishing patterns. It may be purchased or made, but it is better to cut one's own shellac, buying the standard yellow shellac and cutting it either in grain or wood alcohol. A mixture of wood and grain alcohol will not work well, and many forms of denatured alcohol will not work well, as these blends interfere with the shellac in some way, making a muddy varnish which does not give a good finish.

Casting without Complete Patterns

To produce a casting it is necessary to have an impression in the sand corresponding to its form. This impression may be made by means of a solid pattern, as already described, or by cutting the opening in the sand with suitable strikes or tools. This is called sweep work. All sweeps must be guided in some manner either from a straight-edge and a curved guide, or a spindle. One of the simple examples of sweep work is the making of a short flange pipe-section such as is shown in Fig. 6. In this case the pipe is 3 ft. long and 16 in. diameter. The bolt holes in the flanges are drilled after the casting is made.

The making of a casting of this kind by the method to be described necessitates the use of a strong, rigid flask capable of supporting the sweep. The sweep is made as shown in Fig. 7, and consists of an iron shaft *A* which may be of any convenient diameter or may even be made of a piece of gas pipe about 2 in. in diameter. To one end of the shaft are fitted two collars *B B*, the space between the collars being equal to the thickness of one end of the flask.

The sweep proper is a board *C* which is cut so that its outer edge has the form of the pipe and core print. The edge *D* forms the impression for the outer surface of the pipe as shown at *D*, Fig. 6. The projections *E E* cut the impressions for the flanges *E E*, Fig. 6, while the portions of the sweep *F F* cut the impressions for the core print to support the core for forming the inside of the pipe. The projections *G G* are placed on the sweep simply to form additional clearance at the ends of the prints to aid in taking off the vent from the core. The sweep is clamped to the spindle *A* by means of two clamps *H H*. For use the sweep is laid across the top of the flask which is shown in Fig. 8, the spindle *A* resting in the notches *I I*. The two collars *B B* fit over one end of the flask and hold the sweep in place. Sand is then rammed into the mold and the form of the pipe swept out by rotating the sweep. The halves of the flask must be perfectly level on top and when the upper surface is reached the sand is struck level.

The cope and drag portions of the flask are made separately, each having a perfectly level parting, and they are then assembled, taking care to bring impressions left by the spindle into perfect alinement and to aline the flasks at the end which was used as a guide for the spindle. For pouring a casting of this kind, two gates will be of advantage as indicated at *J J*. Of course, in the case of the cope it will be necessary to have bars in the flask to help support the sand and also to have a bottom board clamped firmly on while the cope is being rammed and struck. After the cope is rolled over and assembled on the mold the board upon which it is rammed is removed.

The down gates or sprues which come opposite the runways *J J* may be formed by means of pins or gate sticks during the ramming of the mold or they may be

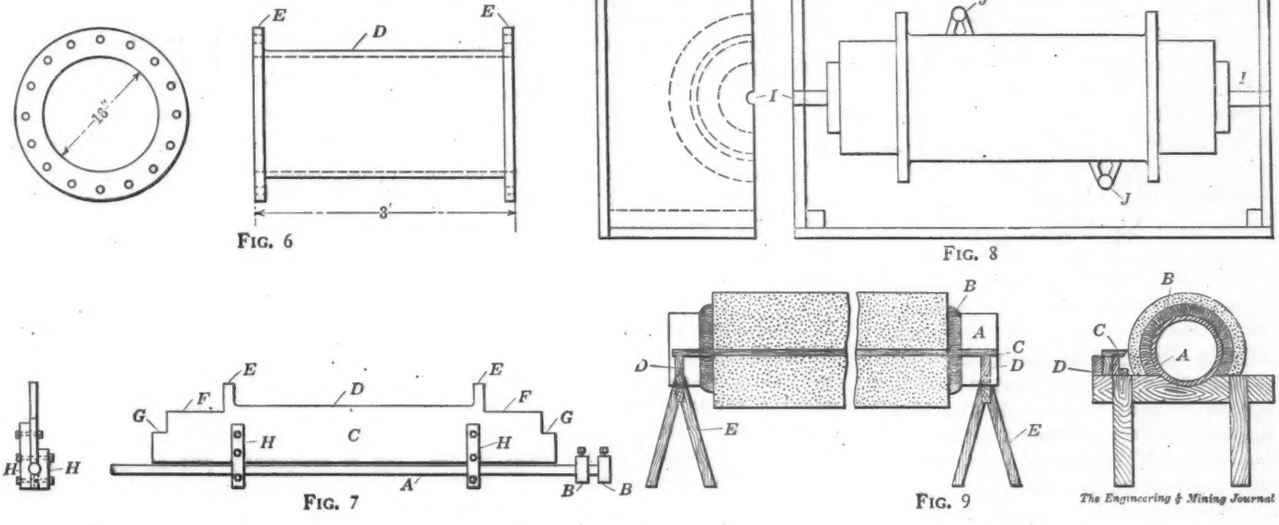

FIG. 6 FIG. 8 FIG. 7 FIG. 9

CORE BOX AND METHOD OF MAKING CORES

punched through the sand afterward by means of a piece of pipe; it is better, however, to form them with a sprue stick or pin during the ramming.

The Use of Struck Cores

Of course, the core must be placed in the mold before it is closed. To avoid the use of a core box in a case of this kind, a struck core is generally employed. One method of making this is shown in Fig. 9. A piece of iron pipe *A A*, from three to six inches smaller in diameter than the interior of the casting to be made, is taken and a number of holes drilled through it to permit the escape of the gases; next a layer of hay rope made by twisting hay into a rope about 1¼ in. diameter is wound around the core as shown at *B B*. This forms a layer over the entire face of the pipe. Next a fairly stiff loam-mud is made from clay and sand to which a little sawdust is usually added. This material is then struck on the outside of the core by means of a strike bar *C*, which is supported on blocks *D D*, resting on the horses *E E* that support the core arbor *A*. By rotating the core arbor *A* past the strike *C*, the loam mud may be formed into a perfect and well packed core. This is then dried and after drying is given a coat made of clay wash and blacking, and dried again.

Clay Washes

The clay wash is made by mixing clay with water to about the consistency of cream, then stirring into it a quantity of coke dust or graphite blacking which should be ground to pass a 100-mesh screen. A wet blacking of this kind is used on the faces of both dry-sand molds and cores. The material for making the blacking may be purchased from regular foundry-supply houses or in isolated places it may be made by grinding coke to a fine powder. Sometimes ground charcoal is used in place of the coke, but it is difficut to get the charcoal thoroughly mixed with the clay on account of its exceeding lightness and porous nature. Ground soapstone or talc makes an excellent material to mix with the clay wash and to use with the facing

Formerly all wet blackings were mixed with clay wash; later many foundrymen took to using molasses or other adhesive materials in clay wash. Glutrin is frequently used in blacking mixtures with or without clay wash. Facing mixtures of either blacking or soapstone may be made by taking one part glutrin and from two to four parts water, then stirring into this the blacking which may be ground anthracite, ground coke, or fine graphite, or if a soapstone blacking is to be made, ground soapstone or talc is stirred in

Fair work may be done without the use of any facing at all, providing the core is thoroughly dry, the only difficulty being that the iron may adhere to the sand and some of the sand and clay be burnt into the iron. The blacking serves to form a separation between the material of the core and the iron. As the foundryman expresses it, it serves to peel the casting.

Sea Coal to Aid Peeling

At this point it may be well to speak of facings and methods of peeling castings. There are two radically different methods of obtaining a smooth surface on a casting, both of which have for their object the prevention of the sand and clay being melted and burning into the face of the casting. The first method is commonly used in green-sand work, and accomplishes the results by using what is commonly called "sea coal." This name originated from the fact that in America this type of facings was first made from coals containing a high percentage of volatile matter, which were brought over sea. Sea coal is nothing but bituminous or gas-house coal ground to a fine powder so that it will pass a 100-mesh sieve. This is mixed with the molding sand which is to be used next to the face of the casting in proportions of one of coal to 10 parts sand.

When the metal strikes the face of the mold, it immediately begins to distil the gases from the sea coal contained in the facing. Two results follow—first, the gas distilled creates a slight pressure in the sand which tends to keep the skin of metal first chilled or hardened from lying in close contact with the sand and so prevents the metal searching into the sand; second, the distilling of these gases absorbs heat rapidly and so tends to keep the sand next to the face of the casting below the fusing point of the constituents in the sand which would make a glass or slag that would adhere to the casting. By the time the sea coal has been burned out next to the face of the casting, this portion of the sand is rendered highly porous so that it will clean away from the casting freely and easily. The sea-coal method is applicable only to light work, that is, castings less than 1½ to 2 in. in thickness. For heavier work it is best to use some form of blacking on the face of the molds.

Facing Mixtures

The blacking used on the face of the molds was formerly wholly composed of carbon, and for this purpose graphite, coke dust or charcoal was used. The blacking, however, must not contain material which would give off gas and for this reason bituminous coal was never used. Anthracite coal is frequently ground and made into blacking. These forms of carbon are highly refractory and when mixed with a fire-clay wash and painted on the face of the mold, form a protective coating which is not easily fused by the molten metal and this coating will usually peel off, leaving a clean surface on the casting. Where wet blacking is used, that is, carbonaceous material mixed with clay wash, the face of the molds must be carefully dried. This is usually accomplished by hanging baskets or boxes of charcoal in the mold and firing them. The cope is sometimes skin-dried over a charcoal fifire.

If a mold is to be skin-dried, the molding sand must contain more clay than is commonly present in the sand used for green-sand work. If the sand does not contain a sufficient amount of clay the deficit may be made up by wetting down the facing sand with clay wash, or clay wash and glutrin, or molasses. The wet blacking, that is, the mixture of carbonaceous matter and clay wash with glutrin or molasses is put on either with a brush or a swab and in many cases it is then finished with a trowel, though if the swabbing is done properly the surface will be in proper condition.

Talc Used as Facing

In many mining regions there are forms of talc or partially decomposed lava rocks which can be ground and used to make a mineral facing, or a fair facing may be made by grinding coke and mixing it with clay wash and glutrin or molasses. In the case of emergency castings a perfect surface is not of high importance, and for this reason facings are frequently dispensed with entirely. This, however, may cause a good deal of chipping in cleaning the casting.

For work of medium weight the facing is frequently put on dry. In this case the surface of the mold may be dampened by spraying it lightly with water containing glutrin or molasses, either blowing it from the mouth as a Chinaman sprinkles his clothes, or using a spray can. After this the coke dust may be shaken on the horizontal surfaces from a bag, or placed dry on vertical surfaces by a brush. The foundry-supply houses have powdered-graphite facings which should be applied in this way. Sometimes the face of the mold is naturally damp enough so that it will hold a sufficient amount of dry facing to protect it. Powdered talc may also be dusted on the face; small work may be protected by powdered charcoal.

For grinding coal for sea coal or coke for facing any kind of an iron box or container may be bolted to a shaft and a small amount of coal and some scrap iron placed in it and left to rotate. If a small tumbling barrel is available it may be used for this purpose or a small amount of facing may be made by grinding the material in a mortar.

The Genesis of Ore Deposits—I

By Edgar K. Soper*

Geologists agree that igneous rocks are the source of metals, but the source of the metal-carrying solutions is not settled, some holding for meteoric and others for magmatic origin. No one theory satisfies all deposits.

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The earliest contributions to the genetic principles underlying the science of ore deposits were made by Werner, the German geologist, who, in 1791, put forth his theory that "mineral veins and eruptive dikes" owed their origin to chemical precipitation from the waters of the seas and oceans. A few years later Hutton, in England, voiced the opinion that dikes and veins were the result of the consolidation of igneous magmas which were introduced into the rocks. While both Werner and Hutton were partially correct, they weakened their deductions by attempting too broad a generalization.

In 1859 Von Cotta published the conclusions derived from the observations of the Freiberg geologists. In this paper only one type of ore deposit was emphasized; i.e., the fissure-vein type. The narrowness of this theory was gradually overcome to a certain extent, but only to give way to a different conception almost as narrow, which was given birth about 1882 by Sandberger, and which is still known as the theory of lateral secretion. Sandberger and his followers held that ore deposits were the result of leaching of metals from the inclosing rocks in the immediate vicinity of the orebody. The importance of chemical study was unduly emphasized at the expense of physical and structural conditions which were not satisfactorily explained by the lateral-secretion theory.

From 1892 until late in the nineteenth century, the Germans led in the study and investigation of the genesis of ores; but it remained for the geologists of America to recognize the economic value of this branch of the science of geology, and the great progress made in the last 10 or 20 years in adding to our knowledge of the formation of ore deposits is largely due to their efforts.

Two Great Classes of Deposits

Ore deposits, whatever their origin, may be divided into two great classes: (1) Those formed contemporaneously with the rocks in which they occur, called syngenetic; and (2) those formed subsequently to the rocks in which they are found, or epigenetic. To the first division belong certain ores in igneous rocks and a few in sedimentary ones. Most orebodies, however, are thought to fall within the second division, or epigenetic class. It must not be inferred from the foregoing statement that all ore deposits may be definitely classified and "pigeon-holed" into one of these divisions, for the origin of many known deposits is still in doubt, and some orebodies which are now thought to be syngenetic may later prove to belong to the epigenetic class, and some now classified as epigenetic may be syngenetic. Assuming that it is possible to determine whether a given deposit has been formed at the same time as its inclosing walls, or later, the all-important questions still remain as to the manner of concentration of the metalliferous minerals and their original source.

We know the outer crust of the earth only to a slight depth when compared to its entire thickness. The deepest mine shaft in the world—that of the Calumet & Hecla in Michigan—is down only 5300 ft., and few of the others attain a depth of 4000 ft. Consequently our knowledge of the interior of the earth is limited to our reasoning and deductions from the all too meager evidence at hand near the surface. That the ultimate source of all metals was the original, or primary rocks of the earth (which we call igneous or volcanic for want of a better term) is uniformly admitted. But it is in the attempt to explain the various ways in which these substances were brought up from the depths, and dissolved, transported, redissolved and redeposited to form orebodies, that geologists meet with difficulty; and different lines of reasoning give rise to divergent theories.

Density of Earth's Interior

The interior of the earth has been estimated to possess a specific gravity of 15, assuming that the density increases at a uniform rate from the surface downward. Whether the center of the earth be composed of a mass of material possessing greater specific gravity than that of the outer shell, or lithosphere; or whether it be a homogeneous mass, is a disputed point. It is maintained that either condition might exist and yet permit of satisfactory explanation of the high specific gravity at the center. It is conceivable that the tremendous pressure that must be exerted upon that material at the core of the earth may result in a substance of greater density, and explain the high specific gravity, without calling upon the theory advanced by some writers that the heavier metallic materials will naturally concentrate at the center. That the conditions of heat and pressure existing here are tremendous, we know.

Furthermore, we know that there exist stresses within the earth, which are constantly at work exerting great force in many directions. The intensity of these forces and the directions in which they act are constantly changing. When one of any set of these forces becomes so great that the others are unable to resist it, equilibrium is destroyed and a readjustment must necessarily follow. It has been demonstrated beyond doubt, by actual experiment, that under conditions of sufficient heat and pressure, the hardest rocks which make up the lithosphere act as plastic bodies and become compressed and deformed in accordance with the intensity and direction of the forces acting upon them.

Three Zones in Earth's Crust

Van Hise suggests[1] that the earth's crust may be divided into three zones: (1) an upper zone of fracture, beginning at the surface and extending downward to (2) the zone of combined fracture and flowage, which is underlain by (3) a zone of rock flowage, or no fracture. Into this last zone no water can penetrate since no fractures, however small, may exist there; for at a certain depth, which may vary with the kind of rock, the pressure exerted by the surrounding material must necessarily seal up any fissure as soon as it is formed.

Geologists no longer contend that open cavities or fissures in the rock are essential to a deposition of ore from circulating underground waters of either meteoric or magmatic origin. The replacement of one mineral by another is known as metasomatism, and that such replacement is responsible for many important ore deposits is an established fact. However, the majority of vein and chamber deposits have probably been formed in cavities of some sort, and in order to more clearly understand the processes of ore deposition under such conditions, it is necessary to study the factors controlling the formation of rock cavities, and to know the various forms that these may assume.

Cavities Formed in Two Ways

Rock cavities are formed in two ways: (1) By solution; and (2) by fracturing. The solvent power of acidulated waters is well known, and it will be readily conceived how such a solution, passing slowly along a minute fracture in the rocks, may widen its channels by taking portions of the minerals composing the rock into solution, and transporting them away. If

[1] "Treatise on Metamorphism," Monograph XLVII, U. S. Geol. Surv., 1905, p. 1005.

the water be hot and under pressure, this action will be greatly accelerated. Limestone is the most easily soluble of all the rocks composing the earth's crust. For that reason we would expect to find solution cavities most numerous in this rock and such is actually the case.

Many of the so called "chamber deposits," or "cave deposits," occurring in limestone, are examples of orebodies filling old cavities formed by solution. Some fissures are widened in this manner and later mineralization may cause veins to be formed here. The power of circulating waters to dissolve rocks and form cavities is well illustrated by the Mammoth Cave of Kentucky, which has upward of 40 miles of underground caverns, all doubtless due to the solvent action of circulating waters on the limestone of that region. It has been estimated that 12,000,000 cu.yd. of material have been removed in its formation. The chief characteristic of cavities formed by solution is their extreme irregularity of outline, and this feature will often serve to distinguish such an opening from one produced by fracture.

Cavities by Fracturing

Cavities due to fracturing may be produced in four ways: (1) By shrinkage of the rock mass; (2) by folding; (3) by faulting; (4) by earthquakes. Fracture cavities, whatever their direct cause, are more important as a possible home of ore deposits than solution cavities, for they may occur in any kind of rock and in a great variety of shapes. It must be borne in mind, however, that beyond a certain depth no cavity in the rocks can remain open. Cavities produced by shrinkage are more common in igneous rocks, although shrinkage of the sedimentaries is also accompanied by fracturing. When an intrusion of igneous material comes to rest, it cools first in its upper and outer portions. The central part of the mass, which may still be somewhat liquid and highly heated, sends off steam and vapors under high pressure, which may be sufficient to fracture the already hardened, but thin, crust. Into these fractures the molten magma below may force its way, and this cooling and fracturing process may be repeated several times.

The intrusion of such a magma into the overlying strata will cause the adjacent rocks to likewise become highly heated, and the rise in temperature will be accompanied by an expansion of the mass. Upon cooling, contraction will occur which often causes complex fracturing, and explains the shattered condition of many sedimentaries in the immediate vicinity of igneous intrusives. During the consolidation of certain sediments, such as shales, the contraction which accompanies the loss of moisture during the drying may be accompanied by fracturing and the formation of "joint planes." These may subsequently serve as pathways for mineralizing solutions. When calcareous limestone is altered to dolomitic limestone, the chemical change is accompanied by a shrinkage of the mass which may be as great as 12 per cent. This may explain the brecciated character of certain limestones of this character.

Folding is usually the result of strain caused by lateral pressure in the rocks. The folding of rocks is widespread and is often highly developed in mineralized regions. Fractures are produced by folding when the strain seeks relief along the axes of anticlines and synclines. Rock cavities may also be produced along the crests of such folds by a warping or contraction of the strata, and these cavities may become filled with ore, forming the saddle reefs similar to those at Hargreaves, New South Wales.

Faulting is one of the commonest causes of rock cavities. Without considering in detail the many kinds of faults which may occur, the character of the fracture produced will depend largely upon the kind of rock displaced. Fault fractures are sometimes left open, but more commonly are filled with débris that permits the percolation of water. This crushed filling may be derived from the fissure walls, or it may work its way down from the surface. Subsequently the fragments may be cemented by minerals deposited from solution, forming fault breccia.

Meteoric vs. Magmatic Waters

While all geologists will probably agree as to the ultimate source of the metals, when we come to explain the manner in which the ore arrived at its present resting place, and whence it was concentrated, and by what agencies, we meet with a problem that has not been explained satisfactorily by any one theory. It will be admitted by all that water is a most important ore carrier, but there exists a difference of opinion regarding the source of the water. One class believes that the water is largely of meteoric origin and that most important orebodies, with certain exceptions, are concentrated by this agency. The other class maintains that the ore-carrying waters are chiefly derived from igneous intrusions. The supporters of the two different theories each base their arguments on many observations taken from all classes of ore deposits, and much enlightenment on the subject in general has been gained from their discussions.

Deposits from Meteoric Waters

Many of the earlier geologists, chief among whom were Joseph Le Conte[2], F. Posepny[3] and L. De Launey[4], maintained that meteoric waters were the most important collecting agents of ore. Of late years, C. R. Van Hise[5] has strongly advocated a theory of ore formation by meteoric waters. While cold water, when pure, has comparatively little solvent power, it is well known that when under heat and pressure and with the addition of small amounts of acids or alkalies, the solvent power of waters is tremendously increased. Rain, falling upon the surface, seeps into the ground and into the underlying rocks, forming a more or less saturated zone, the upper limit of which is known as the ground-water level or water table.

Solvent Power of Water

Above the ground-water level there is another belt of underground water circulation extending to the surface. A part of this water soon finds its way to the surface again, but a large part of it fills the pores and interstitial spaces of the rocks and permeates the zone of fracture. A small part of it may even extend into the zone of combined fracture and flowage. As this water descends, its temperature is constantly increasing, and it continually flows under greater pressure so that its solvent power becomes rapidly increased. Certain acids and alkalies are taken into solution, so that by the time these slowly circulating waters have reached a position well down in the zone of fracture, they are capable of dissolving almost any of the metals which may occur disseminated in minute quantities through the rocks which the solutions search.

While the movements of underground waters are exceedingly complex, they can be divided into two components; vertical and horizontal. Furthermore, there is a strong tendency for these waters, circulating through the pores in the rocks, to flow toward, and concentrate in the larger fissures and cavities. As the solutions attain greater depth the temperature and pressure become so great as to prevent their further migration downward into the rocks which are increasing in density. Above the level of ground water the reactions are principally carbonation, hydration, oxidation and solution, disintegration and decomposition. Little, if any, deposition takes place. This zone has been called by Van Hise the belt of weathering.

In the lower portion of the zone of fracture, which is designated the belt of cementation, the most active circulating solutions are those which are ascending, and the chief reactions here are hydration, carbonation, oxidation and deposition. Little, if any, solution takes place. Deposition would be favored in rising solutions, for the temperature and pressure are constantly decreasing; there is a loss

[2] *Am. Journ. Sci.*, July, 1883, p. 1.

[3] *Trans.* A. I. M. E., XXIII, p. 213.

[4] "La Recherche Captage, et Amenagement des Sources Thermo-Minerales."

[5] "Some Principles Controlling the Deposition of Ores," *Trans.* A. I. M. E., 1901, pp. 27-177.

of CO_2, if any is present, and hence the mineral-bearing solutions will gradually precipitate their burdens as their solvent power becomes lost. There are, however, more important factors than decrease of temperature and pressure which control the precipitation of ores by ascending waters. These factors are: (1) The mingling of various solutions; (2) reactions between materials of the wall rocks and materials in solution; (3) reactions between gases and solutions, or solids, or both[5]. The mineral matter which is taken into solution in the belt of weathering is carried downward into the belt of cementation, where it is conducted to the trunk channels by lateral moving solutions. Thus there is a constant migration of the material in the belt of weathering to the belt of cementation, where it is finally deposited. A given mineral may have been dissolved, precipitated, redissolved and reprecipitated several times before reaching its place in the orebody.

Primary and Secondary Enrichment

That the precipitation will take place chiefly along open fissures and cavities, follows, because it is natural that these open fissures will serve as trunk channels for the rising solutions. Another factor in favor of precipitation of mineral matter in the larger openings is the fact that there would be a sudden loss of pressure in a solution flowing abruptly from minute crevices or pores in the rocks into larger and more unobstructed channels. Again, if two or more solutions of different composition meet in the trunk channels (where they would be almost sure to meet), a chemical reaction would probably occur and the result would be the precipitation of mineral matter along the walls of the fissure.

Assuming that a first concentration of ore minerals may be brought about in the manner briefly outlined, it is not yet sufficient to explain the richness and size of some deposits, especially in the upper portions, and the frequent occurrence there of the more valuable oxidized products. It is concluded, and this conclusion is generally accepted by economic geologists, that most orebodies require a second concentration or enrichment before deposits result, of sufficient value to be profitably mined. In secondary enrichment, descending meteoric waters play a most important part. The belt of weathering is constantly migrating downward, because of erosion of the surface, and an upper belt of second concentrates is, therefore, produced from the first concentrates formed by ascending waters. This action will be considered more in detail later.

While there can be no doubt that some ores owe their concentration to circulating meteoric waters, a theory that attempts to explain the origin of most deposits by this method, must meet with arguments difficult to overcome. In the first place, one of the fundamental premises of such a theory is that the material for ore deposits is derived from rocks within the zone of fracture. The depth to which this zone extends cannot be determined, but the maximum depth has been estimated to be several thousand meters. The next 5000 m., or less (16,250 ft.) constitutes the zone of combined fracture and flowage; while at a depth of 10,000 m. (32,500 ft.), or less, the strongest rocks will flow.

Even if the upper 5000 m. of the earth's crust were searched by circulating meteoric waters and the metals concentrated, there might be room to question whether this would furnish enough metalliferous material to form the extensive deposits now known. As a matter of fact, meteoric waters do not attain depths anywhere near as great as 16,000 ft. It is probable that meteoric waters seldom reach a depth greater than 2000 ft., and then it is only when they have followed open fissures in the rocks. In the case of some mines less than 2000 ft. deep, the bottom levels are quite dry.

Deposits from Magmatic Waters

The theory of the concentration of orebodies by magmatic, or juvenile waters, is by no means a new one, for as early as 1850 Elie de Beaumont[6] realized its possibilities, and suggested such an origin for certain deposits. Since then many important observations have been made on all types of ore deposits and the evidence gathered has pointed more and more to the role played by magmatic solutions in the genesis of ores. Of late years the writings of Vogt[7], Spurr[8], Lindgren[9], Emmons[10], Kemp[11], Weed[12] and others have done much to emphasize the close relationship that exists between ores and igneous rocks. The most important observations supporting the theory of ore deposition by waters of magmatic origin are the following:

(1) Igneous magmas contain considerable quantities of water. This has long been known and ample evidence of water in igneous rocks is furnished by the vast quantities of steam given off from volcanoes; by the experiments of Daubray, who showed that molten granite contains much water vapor which it gives off on rising toward the surface; by the analysis of igneous rocks, which show water in chemical union with the other constituents; by the water of crystallization found in certain minerals known to have formed in lava flows, etc.

(2) It is extremely suggestive that most metalliferous veins are formed in the vicinity of igneous rocks. The association of ores and igneous rocks, especially in the case of the gold deposits of North America, has been discussed at length by Lindgren[13], who shows that the periods of gold vein formation agree closely with periods of igneous activity.

(3) In the case of ore deposits other than fissure veins, with the exception of some deposits of iron, lead, zinc and copper, the orebodies usually occur associated with igneous intrusives. It is not likely this frequent and intimate relationship between the two is merely a coincidence.

(4) A highly important consideration is the dry and dusty condition of the bottom levels of many deep mines, which are still working in good ore.

(5) Ores frequently have been concentrated below the lower level of the ground-water zone. The ore occurring here is usually of a lower grade than that found above, due to the fact that secondary enrichment by meteoric waters has been active in the upper regions of the deposit, where weathering has rendered the rock more accessible to descending waters. In general the depth of secondary alteration is dependent on, and determined by, the depth of the water zone. Where secondary alteration is no longer observed, and primary ores are encountered, there is a marked decrease in the amount of water present, until finally the mine becomes dry. If the primary ore continues in depth below the water zone, as it frequently does, its presence there must be due to agents other than meteoric waters, unless there has been a change in the depth of the water zone due to climate changes or structural readjustment. That such changes control the depth of maximum water circulation is well known, but the presence of igneous intrusives in close proximity to the primary ore is strong evidence that the deposit owes its existence to magmatic agencies.

(6) Processes of ore deposition which require the action of hot ascending waters or watery vapors are most active near igneous contracts.

(7) The force of the intrusion of a magma into the overlying strata may shatter the sedimentary rocks, and thus avenues would be established for the circulation of mineral-bearing solutions.

Magmatic Segregation

Where there are large igneous intrusions in the rocks, there is often a tendency for the metals contained in the magma to concentrate during the process of cooling. This action is known as

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[6] *Bull.* IV, Geol. Soc., France, p. 1249.

[7] *Zeit. für prak.* Geol. II (1894).

[8] U. S. Geol. Surv. 16th Annual Report, II; also *Econ. Geol.* II, 8, p. 781 (1907).

[9] *Bull.* VI, Geol. Soc. Am., p. 240 (1895).

[10] *Bull.* 15, Geol. Soc. Am., 1 (1904).

[11] *Trans.* A. I. M. E., Vol. XXXIII, p. 699, 1903; also Vol. XXXI, p. 169.

[12] *Trans.* A. I. M. E., Vol. XXXIII, p. 715.

[13] "Metallogenetic Epochs," *Econ. Geol.* IV, 409 (1909).

magmatic segregation. During the cooling process of a magma, the more basic elements are the first to crystallize. Consider the magma as an igneous rock in a fluid condition. It is only restrained from crystallizing into an aggregate of minerals by heat and pressure. When the heat and pressure are reduced, crystallization will begin, and the point at which it starts is dependent upon the chemical composition of the mixture, and especially upon the amount of water and other mobile elements. As the reduction in heat and pressure continues, more and more of the basic elements will separate from the fluid, which consequently becomes more and more aqueous, until finally we may have a fluid residue consisting chiefly of an aqueous solution containing much silica; the highly mobile and solvent elements, such as fluorine, boron and chlorine; and many metals.

Spurr's Theory of Deposition

In 1907, J. E. Spurr published a theory of ore deposition[14], which involved a new conception of the origin of mineral veins. It is here maintained that metalliferous fluids, from which most orebodies are precipitated, are extreme phases of magmatic differentiation. As the magma approaches the surface, the minerals contained therein crystallize out in vertical theoretical zones.

The mineral composition of each zone will depend upon the chemical composition of the magma at the time of crystallization, and successive vertical zones of ore deposition may result. The final residue from the magma, consisting of a silicious solution containing the greater portion of the valuable metals in the original magma, may form the quartz veins of ore deposits. This theory proposes that where the igneous rocks associated with ore deposits do not show evidence of magmatic differentiation, both rocks and veins originated in a common center. Furthermore, the difference between ore deposits in different regions depends upon the different "metallographic magma-provinces," which underlie those regions.

Deposits from Magmatic Emanations

While the question of ore genesis by meteoric and magmatic waters is one still under dispute, there is an important class of deposits whose origin can be quite definitely attributed to magmatic emanations, in the form of gases, vapors and liquids, or a combination of any two or more. When a large intrusive comes to rest, it will cool first around its upper and outer portions. The portion of the magma thus cut off from its path of ascent is still in a fluid condition and sends forth gases and watery vapors under high heat and pressure.

This pressure may be sufficient to crack the already hardened crust toward the surface and thus open pathways for the escape of the vapors and gases. Molten rock may be forced into these secondary fissures from the still uncooled portion of the intrusive, and this molten material may mix in all proportions with the waters and vapors. Thus, as the cooling continues downward, there may be repeated fracturing of the freshly cooled rock and constant refilling by the material from below.

It is well known that water and steam at high temperatures dissolve minerals. Water above 185 deg. C. attacks glass readily. Furthermore, the vapors given off by the cooling magma often contain fluorine, boron, chlorine, etc., which extract the metallic elements from the cooling mass to deposit them later in the cracks and fissures reopened in the upper portions of the mass. In this manner ore deposits may be formed by eruptive after actions which begin with the intrusion of the magma, and continue until the rocks are completely cooled. Examples of deposits of this class are certain tin and apatite veins occurring as pegmatites and often containing fluorspar, topaz and tourmaline.

At Waihi, N. Z., there occur veins composed principally of chalcedony, very probably of solfataric (gas-aqueous) origin. The molybdenite deposits of Jeffs Camp, Queensland, occur as rough, circular or oval shaped outcrops of quartz which develop in depth to pipe-shaped masses surrounded on all sides by granite. The quicksilver deposits at Sulphur Bank, California, are doubtless of this class. The basement rocks are slates and sandstones overlain by a fresh-water formation and capped with basalt. The sandstones and slates have brecciated, and this breccia is cemented with a soft silicious paste, containing finely disseminated sulphides, and partly with cinnabar. In some places the basalt is crushed and the spaces filled with silica and cinnabar. Mineralization was probably due to hot aqueous solutions containing gases, and carrying H_2S, which were forced through the interstices in the fractured rocks.

(To be concluded)

[14]"A Theory of Ore Deposition," *Econ. Geol.* 8, 1907, p. 781.

Refining Cobalt District Bullion

A recent specification (U. S. pat. 1,004,676) of Balmer Neilly, Bradford, Ont., gives the following method for getting rid of nickel, copper, cobalt, arsenic and antimony in doré or impure silver bullion. The bullion is melted down in crucibles at a temperature of 1140 deg. C. and iron in the form of nails added until the arsenic and antimony present exist as speiss.

The crucible is then removed and cooled suddenly, after which the speiss and remaining bullion separate cleanly. The bullion is then again melted at a temperature of about 1090 deg. C. with enough flux such as sand and borax to form a thin covering on top of the molten metal and an air blast strong enough to penetrate this slag in one place directed against it until the bullion is refined.

[In this connection it may be recalled that for some years it was standard practice to use iron in the refining of electrolytic slime. The resulting doré was usually higher and the slag lower in tenor than when iron was not used, but we believe the process has now been given up, as the speiss formed was difficult to decompose, and it was thought the high temperatures required in its working resulted in silver losses by volatilization.—Editor.]

New York Mineral Output

The year 1910 did not witness any noticeable extension of mine and quarry operations in the State of New York.[1] One of the few mineral products that showed a decided gain during the year was iron ore, of which the gross output amounted to 1,517,880 long tons. This is probably the largest quantity that has ever been hoisted from the New York mines. The Adirondack region furnished, as usual, the greater part of the product, but the mines in the Clinton belt of central and western New York were more active than for some time. Altogether there were 13 companies who reported a production, as compared with 12 in 1909. The production of salt from the mines and wells of the State amounted to 10,270,273 bbl. exceeding that of any previous year. The mining of gypsum has assumed large proportions of late years, due to the increased manufacture of gypsum plasters for building purposes.

MINERAL PRODUCTION OF NEW YORK IN 1909 AND 1910

	1909	1910
Portland cement, bbl.	2,061,019	3,364,255
Natural rock cement, bbl	549,364	292,760
Building brick, thousands	1,518,023	1,404,345
Crude clay, tons	12,174	6,005
Emery, tons	892	978
Metallic paint, tons	6,560	8,063
Feldspar and quartz, tons	16,111	18,012
Garnet, tons	3,802	5,297
Graphite, lb.	2,342,000	2,619,000
Gypsum, tons	378,232	465,591
Iron ore, long tons	991,008	1,159,067
Talc, tons	50,000	65,000
Natural gas, 1000 cu. ft.	3,825,215	4,815,643
Petroleum, bbl.	1,160,402	1,073,650
Salt, bbl.	9,880,618	10,270,273
Granite, value	$179,955	$244,763
Limestone, value	3,300,383	3,245,807
Marble, value	380,016	341,880
Sandstone, value	1,839,798	1,451,796
Trap, value	1,061,428	909,006
Other materials, value	7,203,003	8,258,652
Total value	$34,742,287	$35,400,257

[1]Bull. 151, New York State Museum.

Electrolytic Refining of Silver

By Edward B. Durham*

An outline of the refining process at the San Francisco mint. A current density of 8.3 amp. per sq. ft. is used; the electrolyte is a solution of silver nitrate, nitric acid, and a little glue which toughens the deposit.

NOTE—Excerpts from a paper, "Electrolytic Refining at the United States Mint, San Francisco, Cal.," presented at the San Francisco meeting of the American Institute of Mining Engineers, October, 1911.

*Berkeley, Cal.

The refinery at the San Francisco mint takes the bullion purchased by the receiving department, and carrying more than 200 parts of precious metals in 1000, or, in mint parlance, over 200 fine, and separates and refines the various metals contained therein, using electrolytic processes exclusively.

General Treatment Plan

Bullion containing silver is treated in cells charged with a nitric electrolyte. These cells produce fine silver and leave a residue rich in gold. The residue from the silver cells, together with crude gold bullion, is treated in cells having a chloride electrolyte. These produce fine gold and leave a residue containing silver chloride. The latter is reduced to the metallic state with zinc and is then treated in the silver cells.

The various waste solutions and wash waters, after being freed from the bulk of their precious metals, still contain copper and other metals. These are removed by scrap iron, and are then treated in the copper cells, having a sulphate electrolyte. These cells produce pure copper, and collect a residue containing lead, some gold and silver and all the metals of the platinum group that were in the bullion. This residue is relatively small, and is melted into bars and stored until sufficient accumulates to warrant treating it for platinum, etc.

The refinery occupies three large and three small rooms. The large ones are: a melting room, 30x34 ft.; a cell room, 39x46 ft.; and a wash room, 30x33 ft. The small rooms are used as foreman's office, laboratory and generator room, respectively. The methods here described are those in use in December, 1909, when notes for the present paper were taken. An outline of the system is shown by the diagram, Fig. 5, which gives the order of events and the interdependence of the various operations in a brief form.

The anodes are made up of crude silver bullion, together with gold bullion that is too low in gold to be easily made up into gold anodes. The endeavor is to make a mixture, such that the anodes will run about 600 parts in silver, 300 gold, and 100 in base metals. The metal is melted in No. 100 graphite crucibles, in Rockwell melting furnaces of the "open-top mint type," heated with crude oil. A drawing of these furnaces is given in Fig. 2. The furnaces are used for melting both the crude metals for the anodes and the fine gold and silver products of the refinery that are to be cast into bars.

The anodes are cast in open cast-iron molds, and are of the dimensions given in Fig. 4. They are suspended from the conductors by C-shaped hooks of gold, which pass through the hole at the top of the anodes and over bars which form the conductors for the current. The anodes are immersed for their full depth in the electrolyte.

The cathodes are made of sheets of silver, 1000 fine, 0.051 in. thick (No 16 B. & S. gage) and 4 in. wide. They are immersed for 8.5 in. in the electrolyte, and are bent over at the top so as to hang from the conductors.

The crystallized silver that collects on the cathodes is loose and is removed daily. To facilitate this stripping, the cathode sheets are treated with a "dope,"

FIG. 1. VIEW OF CELL ROOM AT THE U. S. MINT, SAN FRANCISCO, CAL.

consisting of silver nitrate, copper nitrate and hydrochloric acid, all mixed together and painted on with a rag. The sheets are then dried in the dry room. One dose of this dope lasts two or three months; then the deposits begin to stick, and the plates are retreated.

The Electrolyte

The electrolyte consists of water with 3 per cent. of silver, as silver nitrate, from 1.5 to 2.5 of free nitric acid, and a little glue. The last is dissolved and poured in as a thick liquid. The effect of the glue is to toughen the deposit of silver on the cathode.

The electrolyte dissolves and retains the copper and other soluble base metals. These do no harm until the solution becomes so strong that the purity of the silver deposited on the cathodes is affected, when it has to be changed.

The cells are of brown earthenware and their dimensions are shown in Fig. 3. Experience has shown that they are too shallow for advantageous work. There is only a small space between the bottom of the cell and the lower end of the anodes, and the slimes that collect in this space soon cause short circuits which stop the action of the cell. A new set of cells, 18 in. deep inside, instead of 12 in., is about to be installed. These deeper cells will allow longer cathodes to be used, and, since the cores that have to be retreated will be of the same size, there will be a reduction in the percentage of metal to be retreated.

The cells are placed end to end in a double row on two long benches, 12 on one bench and 6 on the other. This allows all the cells to be easily inspected and attended to, from one side or the other of the benches.

The anodes and cathodes are hung in alternate rows from maple strips, 2⅛ in. apart from center to center, which extend across the cells. Along the top of each is laid a gold strip, bent into the form of an inverted trough. These gold strips are connected by screws alternately to the positive and negative busbars, and form the conductors. There are 19 of these across each cell, 10 supporting four cathodes each and nine supporting four anodes each. The busbars are of copper and extend along the main wooden frame that covers the top of the entire bench of cells. All woodwork and the copper bars are coated with "biturine solution," an asphaltic paint that comes from Australia, to protect them from the action of the acids.

The solution in the cells is kept in motion by two glass propellers in each cell. This prevents the heavier solutions from settling to the bottom, and makes the deposition uniform over the whole cathode. Each propeller, 2 in. across, is made in one piece with a glass rod, which runs up vertically between the electrodes, and is driven by a cord running in a grooved pulley at its top.

Current Density 8.3 Amp. per Sq.Ft.

The current is a direct one of 15 volts, and passes through the 18 cells in series, shown in Fig. 6. The amount of current is such as to give a density of 8.3 amp. per sq.ft. of cathode surface. There are 40 cathodes per cell and each has a normal immersion of 8.5 in. The total current required is therefore $17 \times 8.3 = 141$ amp. The end rows of cathodes have only one effective surface, so the total cathode surface per cell is:

$$(2 \times 8 \times 4) + (2 \times 4) = 72 \text{ surfaces},$$

or

$$\frac{72 \times 4 \times 8.5}{144} = 17 \text{ sq.ft.}$$

Centrifugal machines are used to separate the moisture from the different products of the refining process, and to wash them free from soluble matter. There are two of these machines. No. 1 belongs primarily to the silver process, and is used exclusively for silver or products charged with nitric compounds. No material containing chlorides is ever placed in it. Centrifugal No. 2 is similar to No. 1, but is reserved for the gold process and for solutions carrying chlorides.

The rotors of the centrifugals are of earthenware and provided with ducts for

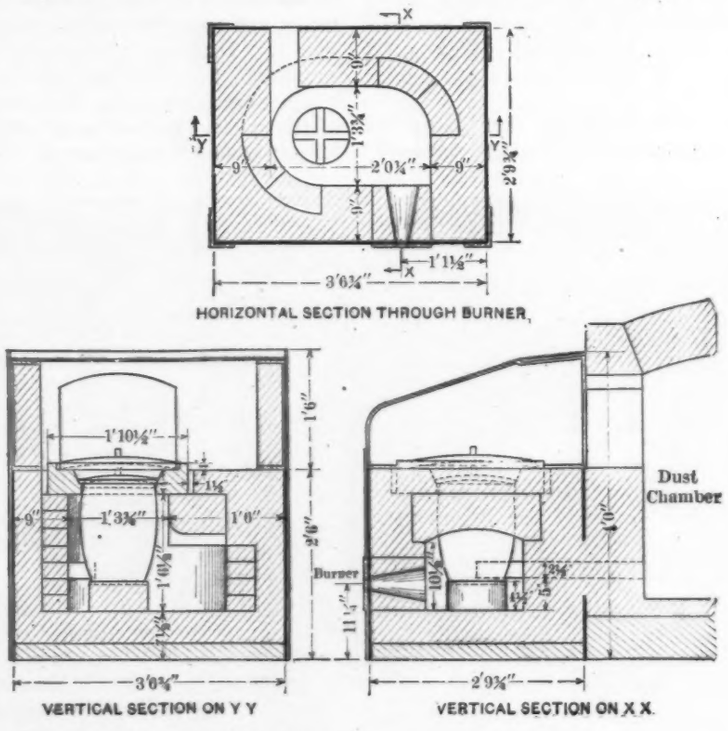

FIG. 2. MELTING FURNACE

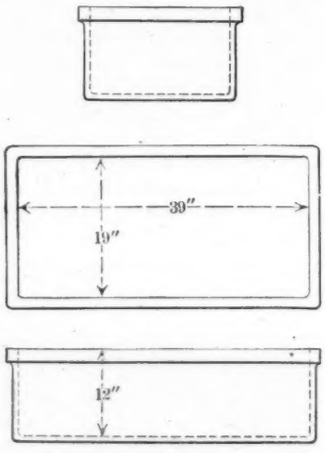

FIG. 3. CELLS OF BROWN EARTHENWARE

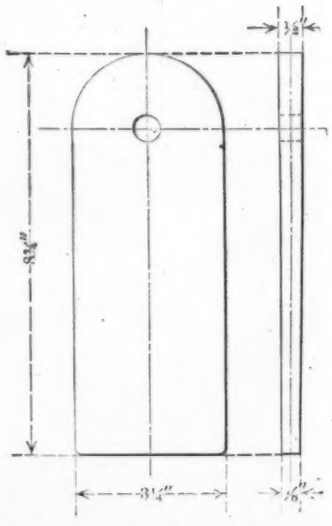

FIG. 4. ANODE FOR BOTH SILVER AND GOLD CELLS

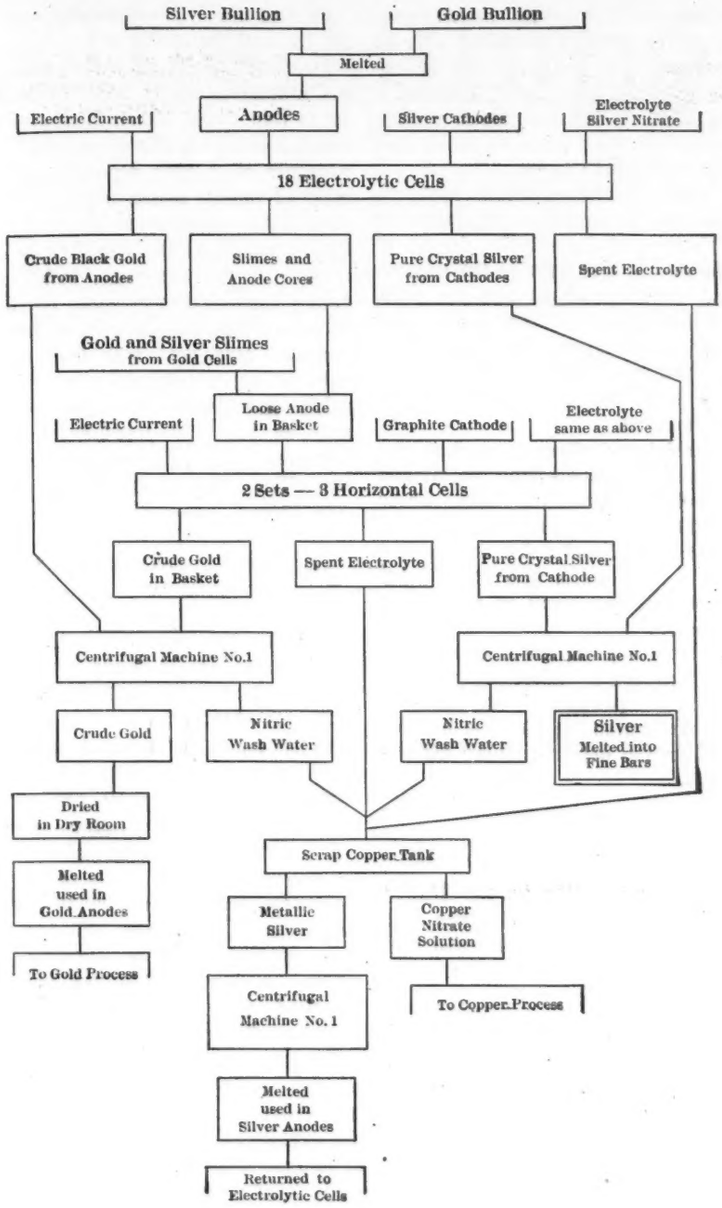

FIG. 5. DIAGRAM OF THE SILVER PROCESS

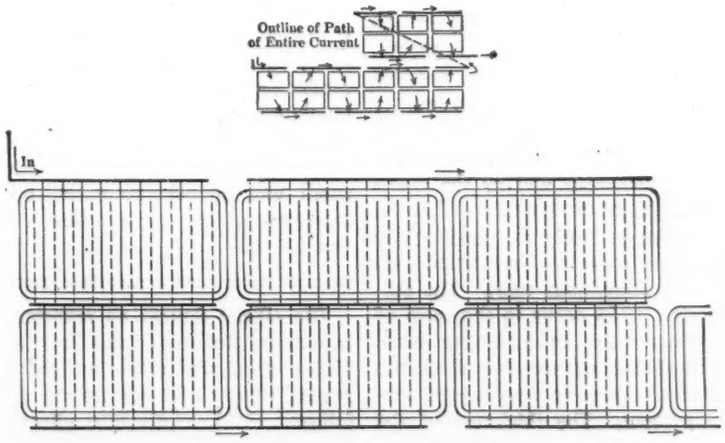

FIG. 6. DIAGRAM OF PATH OF CURRENT THROUGH THE VERTICAL SILVER CELLS

the escape of the liquids. When in use, the rotor is lined with one thickness of 7-oz. duck, and in this bag is placed the material to be treated. A different filter bag is kept for each different kind of material that is washed.

All the products of the silver process can be dried sufficiently in the centrifugals, so that they can be transferred to the crucibles and melted.

Briefly, the anodes are dissolved; pure silver collects on the cathodes; copper and other metals forming soluble nitrates go into the bath, and gold and other insoluble metals are left as a sponge on the anodes. As the dissolving action progresses, the anodes are taken out at intervals and the sponge of insoluble metals is shaken off into an earthenware jar, by knocking them against its sides. This spongy material is crude or black gold with about 10 per cent. of silver and 1 per cent. of base metals. After washing in centrifugal machine No. 2, it is melted into anodes for the gold process.

ELECTROLYTE CHANGED WHEN COPPER CONTENT REACHES 8 PER CENT.

When the anodes are eaten down so that they barely hold together (which takes about 48 hours), they are removed, all the loose, spongy material is knocked off, and the hard cores that remain are treated in the horizontal cells, to be described later. New anodes are then hung in their places.

So long as the electrolyte contains an ample supply of silver, this is deposited in preference to the base metals. The electrolyte is tested at intervals to determine its strength in silver, and if this test shows that the bath is too low in silver, its strength is brought up by adding strong silver nitrate solution.

The test for silver is made by gradually adding a standardized solution of ammonium thiocyanate, NH_4CNS, to a sample of the bath, a little ferric-sulphate solution having been previously added as an indicator. When all the silver has been precipitated, the ferric salt gives a red color. This is Volhard's method, and is given in detail by Sutton[1].

When the bath contains about 8 per cent. of copper it has to be changed, since the silver deposited on the cathodes begins to be contaminated with the copper. This spent electrolyte is treated in the scrap-copper tank to recover the silver, and then passes on to the scrap-iron tank, where the other metals contained in it are caught.

SILVER EASILY REMOVED FROM CATHODES

The pure silver collects in a crystalline condition on the cathodes, which are lifted out daily and cleaned over large porcelain jars. At first, the deposit is loose and fern-like, and most of it can be removed by knocking the cathodes

[1] "Volumetric Analysis," p. 142, seventh edition (1896).

against the sides of the jars. Gradually a firmer deposit collects that will not knock off, and this has to be removed with a scraper, when it comes away in sheets and leaves the cathode entirely clean. This pure silver is washed in centrifugal machine No. 1 until free from acid and soluble salts, and then is whirled until dry enough for melting, when it is made into fine bars.

A second product of this process consists of the slime that accumulates in the bottom of the cells. This contains black gold that has dropped from the anodes, as they dissolved, and also crystalline silver that failed to stick to the cathodes. This slime is transferred to the horizontal cells for retreatment. (In some plants, the anodes are incased in cloth bags, and the black gold is caught before it can drop to the bottom, and is melted for gold anodes, without further treatment.)

Operation of Horizontal Cells

The operation in the horizontal silver cells is the same in principle as in the vertical, but the mechanical details are different. There are two independent sets of the horizontal cells, each having three cells in series. These show at the right-hand end of the first and second benches in Fig. 1. The anodes consist of the cores of the silver anodes from the vertical cells, the slime from the bottom of the vertical silver cells and the silver reduced from the silver-chloride slime from the gold cells. These materials are contained in a wooden basket or tray. The current is led into this mass by a "candle," made of equal parts of gold and silver, the lower end of which is buried in the material. The cathodes consist of graphite plates on the bottom of the cells. The crystalline metallic silver is deposited on these cathodes, and is removed at intervals with a long-handled dipper of hard rubber. The electrolyte is the same as for the vertical silver cells. The current is about 50 amp., and passes through the three cells in series. This gives a current density of 14.3 amp. per sq.ft. of cathode surface, and requires a potential of 5 volts per cell, or a total of 15 volts.

The baskets are made of maple, and all the joints are dovetailed, so that there is no metal in their construction. The bottoms are made with slats, and the baskets are painted all over with biturine solution. They are smaller than the cells, so that the deposited silver can be scraped and gathered from the cathodes through the space between a basket and the side of its cell.

The material to be treated is retained on five layers of 7-oz. duck placed in each basket, and the edges are brought up on all sides above the top of the basket. The baskets are suspended in the electrolyte by cleats resting on the tops of the cells.

The material left in the basket, after all the silver has been dissolved, is crude or black gold, and is transferred to centrifugal machine No. 1 and washed. It is then dried in the dry room, melted, and used with other metal to make gold anodes for the gold process.

The spent electrolyte from both the vertical and the horizontal cells contains silver nitrate and the soluble nitrates of the base metals that were in the original bullion. These solutions and the nitric wash waters from the centrifugal machine are passed over scrap copper suspended in wooden tanks, which precipitates the silver and leaves the base nitrates in solution.

The precipitated silver is washed and dried in centrifugal machine No. 1, and then is melted and cast into bars. These are added to melts of low-grade gold and made into silver anodes for the vertical silver cells. At times, this precipitated silver has been dissolved in nitric acid to make silver nitrate for the electrolyte, but it is often impure, and a better electrolyte is obtained by dissolving pure silver; hence the practice is not common. The solution containing the base nitrates is treated in the copper-refining department.

World's Sulphur Production

The sulphur industry in the United States in 1910 was confined to the four States of Louisiana, Nevada, Utah and Wyoming, the production of the other States being practically negligible as compared with that of Louisiana. The production of sulphur for 1910, according to W. C. Phalen, of the U. S. Geological Survey, was 255,534 long tons, as compared with 239,312 long tons in 1909. In 1910 there were imported into the United States 30,833 long tons of sulphur, while the exports amounted to 30,742 long tons.

Italy is the leading country of the world in the production of sulphur. Italian sulphur comes from four districts, of which Sicily is the most important. No sulphur deposits are found in the northeastern and the extreme southeastern parts of Sicily. It is quite possible that sulphur deposits were in earlier geologic time scattered over the entire island, but were later removed by mountain-making processes and by the denudation and erosion which followed them.

The sulphur in Sicily is found chiefly in argillaceous limestone associated with gypsum and bituminous marl. The sulphur-bearing rocks occur in the form of lenses rather than as extensive beds, the lenses being of variable thickness and richness. Three to four layers usually are present. The thickness of the barren rock between the sulphur layers is as a rule less than three feet.

Within the sulphur-bearing layer proper, the sulphur occurs either in the form of irregular incrustations and small pockets intimately mixed with the limestone or as thin bands interlaminated with the country rock. A fairly safe index of the presence of sulphur deposits is the presence of the so called briscale. This is formed by oxidation of the sulphur and by the action of the sulphuric acid thus formed on the limestone, which is ultimately converted to gypsum. The briscale is crystalline, porous and yellow. The minerals associated with the crystalline sulphur are chiefly celestite, aragonite, calcite and gypsum, the latter in abundance in beautiful transparent crystals. All these minerals, together with the crystalline sulphur, are secondary products formed along joint planes and in fissures and cavities.

The richer deposits carry 15 to 20 per cent. sulphur, but individual deposits are known with 50 per cent.; and in places, as for example at Naro, 80 to 90 per cent. ore is found. Ore carrying less than 8 per cent. is not considered workable. The workable deposits carrying up to 40 per cent. sulphur are considered as limestone impregnated with sulphur; above 40 per cent., as more or less impure sulphur.

The methods of mining Sicilian sulphur are extremely simple. The ore is mined by shafts, leading into which are steps hewn out of the rock. A few mines have modern hoisting machinery and trams. The stall-and-pillar method is practised in a primitive way. The shafts vary from 500 to 825 ft. in depth.

For many years Sicily held a monopoly of the world's sulphur market. This monopoly has recently been broken by the exploitation of the sulphur deposits of Louisiana by the Frasch process. As a result of this, in the year 1908 alone, 80 small mines in Sicily were forced to suspend operations, leaving 404 still in operation. In 1909 the number was still further reduced to 380 mines.

The production of sulphur in Japan has increased in recent years. In 1908 it amounted to 33,785 long tons. Japan occupies third place among the sulphur-producing countries of the world. The sulphur deposits of the country are associated with volcanoes. The domestic consumption of sulphur is extremely small and almost the entire output is exported, chiefly to America, Australia and China.

The official figures as reported in the September *Bulletin* of the Pan American Union give the value of metals exported from Colombia during 1910, as follows: Gold, $3,370,260; silver, $407,660; platinum, $260,633, United States currency.

The Mining Index

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17,103—LOADING MACHINERY—Moderne Transport und Verladeeinrichtungen für Kalisalze. Schorrig. (Bergbau, Aug. 31 and Sept. 7, 1911; 3¾ pp., illus.) Modern transportation and loading devices for potash salts. 40c.

17,104—LOCOMOTIVE—Gasolene Mine Locomotive Used at Trojan Mine, South Dakota. Jesse Simmons. (Eng. and Min. Journ., Sept. 30, 1911; ⅔ p., illus.) 20c.

17,105—LOCOMOTIVES—Führerlose Akkumulatorlokomotiven. J. Recktenwald. (Glückauf, Sept. 23, 1911; 3 pp., illus.) Self-running accumulator locomotives. 40c.

17,106—OIL ENGINES—Modern Diesel Oil Engines. F. Schubeler. (Electrician, Aug. 4, 1911; 1½ pp.) 40c.

17,107—REPAIRING—First Aid to Mining Machinery. Henry M. Lane. (Eng. and Min. Journ., Oct. 14 and 21, 1911; 7⅓ pp., illus.) First and second of series of articles. 20c.

17,108—SMOKE PREVENTION—Washing Dust and Smoke from Chimney Gases at York, England. (Eng. News, Mar. 2, 1911; 1⅓ pp., illus.)

17,109—SMOKESTACKS—An Analysis of the Stresses in Guy Wires. W. M. Wilson. (Can. Engr., Aug. 24, 1911; 3 pp., illus.) 20c.

SAMPLING AND ASSAYING—GENERAL

17,110—ASPHALTIC MATERIAL—Methods for the Examination of Bituminous Road Materials. Prevost Hubbard and Charles S. Reeve. (U. S. Dept. of Agriculture Bull. 38, 911; 45 pp., illus.)

17,111—CUPFERRON: Its Use in Quantitative Analysis. Oskar Baudisch and Victor L. King. (Journ. Ind. and Eng. Chem., Sept., 1911; 1 p.) 60c.

INDUSTRIAL CHEMISTRY

17,112—BOILER WATER—A New Treatment of Water by Means of Aluminum Plates for Preventing Scale in Boilers without the Use of Chemicals. T. R. Duggan. (Journ. Soc. Chem. Ind., Aug. 15, 1911; 1½ pp.)

17,113—BOILER WATER—The Elimination of Oil from Return Feed Water. C. E. Crocker. (Journ., W. Aust. Chamber of Mines, July 31, 1911; 2 pp., illus.) 80c.

17,114—SULPHATE OF AMMONIA—The Production of Sulphate of Ammonia in the Year 1910. C. G. Atwater. (Am. Fertilizer, Sept. 9, 1911; 7 pp.) 20c.

17,115—SULPHURIC ACID—Schwefelsäure Intensivsysteme. Meyer. (Zeit. f. Angew. Chem., Aug. 11, 1911; ½ p.) Fast driving systems of manufacturing sulphuric acid. The author disputes the superiority of the Moritz system over the tangential chamber system. 40c.

MATERIALS OF CONSTRUCTION

17,116—CEMENT MILL MACHINERY—American Cement Mill Machinery. Otto Schott. (Cement Age, Aug., 1911; 5 pp.) 20c.

17,118—PORTLAND CEMENT—Plant and Method of Manufacture of Portland Cement at Limestone Island, New Zealand. F. N. Rhodes. (Proc. Aust. Inst. of Min. Engrs., June 30, 1911; 10 pp.)

17,119—PORTLAND CEMENT—The Effect of Hydrated Lime on Portland Cement Mortar. Harry Gardner. (Eng. Rec., Sept. 9, 1911; 1 p., illus.) 20c.

17,120—PORTLAND-CEMENT MORTAR—Some of the Properties of Oil-Mixed Portland-Cement Mortar and Concrete. Logan Waller Page. (Proc. A. S. C. E., Sept., 1911; 17 pp., illus.)

17,121—SLAG CONCRETE—Blast-Furnace Slag as Concrete Aggregate. (Eng. News, Aug. 10, 1911; 1 p., illus.) 20c.

PERSONAL

Mining and metallurgical engineers are invited to keep THE ENGINEERING AND MINING JOURNAL informed of their movements and appointments.

A. L. Simon has been in St. Petersburg, Russia.

Desaix B. Myers is now in Los Angeles, California.

E. Z. Burns, of Simonds & Burns, New York, is in Cuba on professional business.

M. Medlen, formerly of South Africa, has gone to West Shining Tree, Ont., to inspect a number of prospects.

A. H. Case is now acting manager for the Tennessee Copper Company's plant at Copperhill, Tennessee.

Pentecost Mitchell, of the Oliver Iron Mining Company, has been on the Mesabi range on a tour of inspection.

S. F. Shaw has completed a two-months' investigation of the Porcupine district in Ontario, and is returning to New York.

D. P. Mitchell, formerly general manager of the Zinc Corporation, Ltd., was in New York last week on his way West

R. S. Oliver has resigned his position as manager of the Utah Apex mine, at Bingham, Utah, to engage in other business.

C. W. Hayes has resigned from the U. S. Geological Survey to become vice-president of the Mexican Petroleum Company.

Harold Kingsmill, recently of Porcupine, Ont., has gone to Peru, having accepted a position with the Cerro de Pasco Company.

C. P. Wadsworth, for 23 years chief engineer of the W. J. Rainey Coke Company, in the Connellsville coke region, has resigned.

Frank Downing has accepted a position with the Shenango Furnace Company as chief engineer, succeeding Frank Kennedy, resigned.

Thomas Walters, general manager of the mining department of the Jones & Laughlin Steel Company, has been a visitor on the Mesabi range.

Edward M. Rabb, Jr., has gone to the Jackson district in Graham county, Ari., on professional business. He will be in Tucson about the end of October.

Howard Bancroft has left South America, where he was examining mines, and is now on his way to Mexico, where he expects to remain for several weeks.

Frank H. Probert has left Los Angeles for Ray, Arizona, where he will be engaged in the interests of the Ray Central Copper Company for the next two weeks.

Jesse J. MacDonald expects to spend some time traveling in Utah, Colorado, New Mexico and Arizona in connection with metallurgical work for the Utah Copper Company.

Edgar S. Cook, president of the Warwick Iron and Steel Company, Pottstown, Penn., has returned from a several months' sojourn in Norway and Sweden, studying the iron-ore situation.

Lawrence Uglow, of Kingston, has been awarded the president's gold medal and first prize by the Canadian Mining Institute for a competitive essay open to university students embodying research work.

G. T. Richards, of Philadelphia, and E. B. Hawkins, of Duluth, president and vice-president of the Drake & Stratton Iron Company, have been visiting the Mesabi range in Minnesota.

Edward Bailey Cook, manager of the Warwick Iron and Steel Company, Pottstown, Penn., has sailed for a six weeks' trip abroad, during which he will visit the Spanish iron-ore mines of Sota & Aznar.

C. Colcock Jones has returned to Los Angeles, after an absence of a month on professional business in the ironfields of Michigan, Minnesota and Wisconsin, and a visit to Pittsburg, Philadelphia and New York.

A cablegram from Peking says that Charles M. Schwab has started to return to the United States and that the rebellion has prevented the completion of his negotiations with the Chinese government for battleship work.

W. P. Snyder, Jr., has been appointed assistant to President W. P. Snyder, Sr., of the Shenango Furnace Company, Oliver building, Pittsburg. He is now on a trip to upper Lake ports on the new ore boat, "James M. Schoonmaker," recently launched.

Henry J. Wessinger, who for the past 10 years has been the chief mechanical engineer of the Oliver Iron Mining Company, has resigned and will henceforth devote his time to the management of his private interests. He is the principal owner of the Imperial Iron Works of Duluth.

Alexander Leggat, of Butte, Mont., and G. R. Sheldon, of Salt Lake City, are engaged in an examination of the Bullion and Mayflower mines, near Hailey, Idaho, to determine a course of development with a view to discover the continuations of the rich oreshoots extensively worked in former years.

Reuben W. Leonard, of St. Catharines, Ont., prominently known in connection with the Coniagas mine and the Thorold smeltery, has been appointed by the Canadian government chairman of the National Transcontinental railway commission in place of Hon. S. N. Parent, who recently resigned.

A large party of the directors and shareholders of the Dome mines, Porcupine, Ont., visited the mines Oct. 25. The visitors included Captain De La Mar, of New York; Ambrose Monell, managing director; W. E. Corey, New York; E. C. Converse, New York; E. S. Wood, vice-president of the International Nickel Company; Captain Lawson, superintendent of the Canadian Copper Company, and E. D. Miles, consulting engineer.

OBITUARY

Malcolm M. McDonald died suddenly in New York, Oct. 23, aged 45 years. He was born at Mound House, Nev., and went to Butte, Mont., when a boy. He was widely known as a mining engineer and prospector throughout Montana, Nevada and Utah, and was successful in his work at many places, especially in the newer districts of Nevada. He was interested in several mines at Tonopah and in the Montgomery-Shoshone, at Goldfield. He was very popular among miners and prospectors and left a wide circle of friends.

Robert Evans Young, chief geographer of Canada and superintendent of railway lands in the Interior Department, died suddenly at Ottawa, Oct. 24, the cause being probably heart disease. He was born in Georgetown, Ont., in 1861, and in 1882 passed his examination as Dominion land surveyor, after which he spent about 20 years in survey work in Manitoba and British Columbia. He was appointed chief geographer some years since. Mr. Young was a hard worker and a keen student, and was the author of numerous articles dealing comprehensively with the conditions and resources of the northern portion of Canada. To him is credited much valuable work in his department, and his loss will be much regretted by his associates and by his fellow members of the Canadian Mining Institute.

SOCIETIES and TECHNICAL SCHOOLS

Colorado School of Mines—The junior class in mining spent Oct. 18-21 inspecting the placer and lode mines in the Breckinridge district, Colo. They were accompanied by Professors Schneider and Allen.

Queens' University—The cornerstone of the new metallurgy building at Kingston, Ont., was laid Oct. 18, by Dr. James Douglas, of New York, one of the early graduates. The Gordon Hall chemistry building erected by the province was formally opened by Hon. Dr. Pyne, minister of education, at the same time.

American Iron and Steel Institute—At a meeting held in New York, Oct. 26, it was voted to increase the number of directors from 15 to 21, and the following new directors were chosen: Joseph G. Butler, Youngstown, O.; Isaac M. Scott, Steubenville, O.; Charles S. Price, Johnstown, Penn.; F. W. Roebling, Trenton, N. J.; Robert Hobson, Hamilton, Ont.; Frank I. Witherbee, New York.

Editorial Correspondence

Reports from our own Representatives on Important Events from Many Important Mining Centers of the World

San Francisco

Oct. 25—Judge Ross, of the United States court, at Los Angeles, has again made plain that any denial of the rights of the Southern Pacific railroad to hold and operate oil lands legally under agricultural patent must be made by the Federal Government and that individual claimants have no standing in court. The case of George D. Roberts *et al. versus* the Southern Pacific railroad, involves a large tract of oil land in the Coalinga district under development by the United Development Company, which is claimed by the Southern Pacific under agricultural patent. A similar case filed by Edmund Burke was decided by Judge Ross coincidentally with the Roberts case, both on demurrer. The court did not decide on the merits of the Southern Pacific claim to the lands, but on the point that whether or not the railroad claim is valid the Government alone is competent to institute proceedings denying the validity of the application of the patent to the lands containing petroleum. An appeal was taken from the decision to the United States Supreme Court. There are numerous cases pending, or to be instituted, questioning the validity of the Southern Pacific holdings in some of the richest oilfields of the State; and it is confidently believed that, if the action of the Administration and the ultimate finding of the courts are not too long delayed, there is a possibility that there will be a few barrels of oil left for the Government, but the Southern Pacific is not losing any time nor allowing any grass to grow around the wells to retard drilling and production. The railroad may not legally own any oil lands by virtue of agricultural patent, but it certainly has got oil to burn.

Denver

Oct. 24—The Golden Cycle is the most productive of the Cripple Creek mines today. It is situated at the foot of Bull hill on the southern slope and is in the breccia area. In 1895, then known as the Legal Tender, it was reported on by W. Weston, then ore buyer for the metallic Extraction Company's mill, at Florence, of which Philip Argall was manager, the owner being D. H. Moffat and associates, and the Golden Cycle Mining Company was organized. It struck pay ore six weeks after the company commenced operations and has paid ever since. Moffat and his friends sold out at an immense profit to the present company, of which John T. Milliken is general manager. Today it is recorded that the largest dividend in the history of the district has been paid, the money disbursed amounting to $1,500,000; this constitutes an extra dividend, the regular monthly dividends being $30,000 additional. The mill handles 1000 tons per day, and it is stated that there are 400,000 tons of $25 ore blocked out in the mine. With an example like this, of a good mine and good management, there is little wonder that mining is once again becoming the favorite form of investment and that the dead mines are being resuscitated and the living ones rejuvenated all over the State.

However, as usually occurs with some first-class mines which are paying handsomely, they become a target for litigation, and the announcement of the large dividend was followed the next day by one to the effect that the Christmas company, practically the men owning the Vindicator, had entered a suit for about $2,700,000 against the Cycle company, alleging that the latter has taken ore to that amount from veins that, while they were within the vertical side lines of the Cycle property, have their apexes within the side lines of the Vindicator. It is alleged in the complaint that the extraction of the ore has been going on for many years. If this is true they must have, or should have, known it, and the question arises, why did they not make some effort to stop it before, instead of waiting till now to start the suit?

Salt Lake City

Oct. 26—H. C. Goodrich, chief engineer for the Utah Copper Company, gave out some interesting facts recently in an address before the Utah Society of Engineers.

Steam-shovel operations at the Utah Copper now extend vertically 1500 ft. The orebody lies near the surface in folds; this makes it possible at times to load thousands of tons of ore while removing the capping. There are four ways of breaking rock employed, the gopher method, the Keystone holes, toe holes and pot holes. The tee-driven, gopher holes break the largest amount of material. The Keystone drills are used in stripping and rock mining when the room is limited. The toe holes are driven at the base of the level, allowing the steam shovels to work closer to the face. The pot holes are for trimming the face of the levels. Twenty-five steam shovels, 53 locomotives and 408 cars are now moving 750,000 cu.yd. of material per month, and Bingham cañon now has ample railroad facilities to handle the tonnage of the camp and to accommodate any probable future development.

Butte

Oct. 25—On the night of Oct. 24, the concentrator of the Butte Reduction Works, situated in the southwestern part of Butte, was destroyed by fire, entailing a loss of $350,000, about half of which was covered by insurance, due to expire Nov. 9, 1911. The plant was purchased from W. A. Clark two years ago by the Amalgamated Copper Company and has been allowed to lie idle since then with the exception of the concentrator, upon which Mr. Clark has held a lease for the purpose of treating the zinc ore taken from his Elm Orlu mine and about 350 tons per day have been treated there, giving employment to 50 men working one shift in 24 hours; as a result of the fire the Elm Orlu mine, employing about 300 men, will be closed down until other arrangements can be made for treating the ore. The concentrator, although containing the most valuable machinery, was the poorest building of the plant, it being constructed of wood while the other buildings were built of steel and concrete frames, little wood being used in their construction. The fire originated in the grates of the revolving drier, in the concentrating rooms, used for drying slimes; a low fire was kept banked in the drier a few days of each month and this month it had been burning four days when the fire was discovered, probably due to a hot coal or brand dropping through the revolving grates on some inflammable material. It is not known whether the plant will be rebuilt, although plans were being considered for enlarging and equipping it for the more effective handling of zinc ore. The Butte Reduction Works was the first copper plant to be built in Montana, construction having started 32 years ago, at which time the plant was intended for the reduction of silver ores; as copper production gradually became more important the plant was changed and added to for the treatment of copper ores. The concentrator was operated by electric power and a number of valuable motors were destroyed with the rest of the machinery.

The Milwaukee Power Company is about to begin the construction of an

electric power plant at Yakt falls, 18 miles northwest of Libby in Lincoln county, and J. H. Ehlers, of Spokane, has just made a trip there in the interests of the company, carrying plans and specifications of the proposed plant. The plans call for the development of 3400 h.p., in two units of 1700 h.p. each. A part of the power to be generated there will be used by the Lincoln Gold Mining Company, owning the Sylvanite mines.

Eastern offices of the Davis-Daly company have been removed from 74 Broadway, New York, to 79 Milk street, Boston.

Duluth

Oct. 28—Everything points to a quiet winter on the Mesabi range. It is the general opinion on that range that the recent cut of 20c. per ton in ore rates will have no effect on the operation and production of the mines. Operators think that the cut will be absorbed somewhere between the ore buyers and the users of the finished products and that the range in general may possibly be benefited by a slightly stimulated demand for ore if the 20c. per ton cut is passed along far enough to lower the price of finished products. The outcome of the recent visit of the Minnesota State tax commission to the iron ranges is awaited with some interest in view of the findings of the corresponding commission in Michigan. As is well known, the assessable valuation of the Michigan mines was considerably increased. It was not long afterward that the Minnesota commission commenced to busy itself. It is hoped that no such increase will take place as was inaugurated in the case of the Michigan mines, and in view of the increase made about a year ago, it seems hardly likely that anything more than a nominal one will be made.

Iron-ore shipments during September fell off considerably and it has been announced that the Steel Corporation for the balance of the season will confine its shipments to its own fleet and will charter no more "wild carriers." This means that many boats will go into winter quarters at an unusually early date this year.

Wallace, Ida.

Oct. 24—The Clark property, situated in the Sunset Peak district, will be developed extensively. It is rumored that $1,000,000 will be spent on the work. The Clark vein can be seen for many miles, outcropping almost at the summit and running down the side of the mountain. The surface showing of this vein is probably the best in the entire Cœur d'Alene district. A tunnel, which has already been driven through the mountain, was started on one side and driven on the vein to the surface on the Murray side. Although the vein was strong and easily followed, it did not make ore until the tunnel was nearly to the surface on the Murray side. The new tunnel, which will be the first step in the development, will be started on the Murray side to get the additional depth on the vein and to open the orebody as soon as possible. The work will be pushed rapidly as there is plenty of money available.

Tonopah

Oct. 24—The Tonopah mills are now treating 35,000 tons of ore per month, and the output of the camp is further augmented by shipments of 2500 tons of high-grade ore each month to the smelteries, the larger portion of which is the product of the Belmont mine.

A syndicate of Tonopah men, headed by John G. Kirchen, manager of the Tonopah Extension mine, and R. T. Harris, cashier of the Nevada First National Bank, have subscribed $35,000 to erect another custom mill in this camp on the property of the Manhattan Consolidated company. The plant will consist of 10 stamps, two tube mills and cyanide plant and also a sampling mill. Charles Kirchen will be construction engineer and work will be commenced at once.

Patagonia, Ariz.

Oct. 24—J. S. Hannah, of Placerville, Cal., has bonded the Greaterville placer ground of about 6000 acres from the McAneny estate for $250,000. He is now at work, having brought a crew of 15 men under a competent superintendent from California. He states that he will hydraulic the ground. It is now believed that there is sufficient water available for all purposes, and it is the present intention to create storage reservoirs of sufficient capacity to hold water enough for a year's run. The new company will reach the railroad at Sonoita station on the Benson-Patagonia line. This placer district has produced in the past about $7,000,000, and it is estimated that there is much more left in the gravels of the district. The last concerted effort to work the ground was brought to an abrupt close by reason of the untimely and accidental death of the engineer in charge of the operation.

Porcupine

Oct. 25—Chairman Engelhart, of the Temiskaming & Northern Ontario railroad commission, has confirmed the report regarding the proposed changes in the train service to Porcupine. More and better accommodations will soon be offered and the new service will do away with the long and vexatious delays which patrons of the line are at present subjected to.

B. Cartwright, president of the Temiskaming mine, at Cobalt, has decided not to exercise the option which he holds on the McAuley-Bridge properties, in Bristol township. The option was for nine months, and the price to be paid at the expiration of the period was $500,000 cash. Considerable work was accomplished and three diamond-drill holes were bored to depths of over 300 ft., but the results were not sufficiently encouraging to warrant the continuance of the work. The property showed free gold in many places, but the gold was fine and assays rarely ran over $4 per ton. The permitted lapse of this option will have a depressing effect on property owners and possible investors in Bristol and adjacent townships, as this is the first really serious work that has been undertaken in this section.

Cobalt

Oct. 25—Several of the mines in the northern part of the camp, which derive their water from Sasaginaga lake, are suffering from a serious shortage of water and it is possible that the Buffalo concentrator may have to shut down for about a month. Besides the town of Cobalt, there are four concentrators getting their water supply from this lake, which is of limited extent, and which drains only a small area. Some months ago the mining companies recognized the danger and decided to install a coöperative pumping plant on Meed lake, to pump into Clear lake, from which there is a natural drainage to Sasaginaga. This will not be completed until December, and as the past season has been particularly dry, the mines are already feeling the shortage.

Chihuahua

Oct. 27—The strike of the laborers at the Conchos dam near Santa Rosalia has been settled and over 1000 men have returned to work. The strike was caused by labor agitators who claimed that exhorbitant prices were charged for goods sold at the company's stores and that the hours of labor were too long. At the request of the governor of the state a commission was appointed by the laborers to arbitrate with the company, but as many of the agitators were appointed, the governor refused to recognize the commission unless the agitators were eliminated; then a majority voted to return to work. The only concessions made by the company were the reduction of prices on a few staples and 15 min. less work.

The largest single shipment of ore from the Parral district for many months was made Oct. 21. The train was composed of 48 cars, carrying over 1400 tons of ore from the Santa Barbara, Minas Nuevas, and Parral districts.

At the Chihuahua smeltery three furnaces are in blast and if sufficient labor is available all the furnaces will soon be blown in. Plans are being made to increase the capacity of the plant by erecting two more furnaces, 20 Huntington-Heberlein converters, and four Godfrey roasters. Steel buildings are now being erected for this machinery. When these additions are made the plant will be the largest lead smeltery in the republic.

The Mining News

Reports of New Enterprises. New Machinery. Installations. Development Work and Property Transfers. The Current History of Mining

Alaska

The S.S. "Victoria" reached Seattle, Oct. 24, from Nome, with $1,000,000 in gold bullion.

It is reported that earthquakes in southwestern Alaska, during September and October so shook up the earth and glaciers along the coast that unusually rich gold quartz veins were exposed. Excitement rivaling that of the Klondike stampede in 1897 is said to prevail at Valdez, Cordova, Seward and other towns. The majority of small boats on Prince William sound are reported to have been seized by prospectors bound for Port Wells.

Auk—Henry Bratnober is said to be negotiating for an option on 17 claims on this bay, and owned by six prospectors of Douglas City. A force of men is being sent in to develop the claims.

Seacoast—Some rich ore has recently been encountered on this property, in the Shoup Bay district. These claims are owned by Jack Crumm and associates of Juneau.

Lewis—The old dredge is being rebuilt this winter and will be ready for operation in the early spring on the Kalenborn claims on Independence creek.

Porcupine—Operations at this property near Haines, will soon cease for the winter. The season's work has proved successful and more extensive operations will be carried on in the spring. George A. Charlton has charge.

Alaska-Mexican—During August the mill crushed 18,856 tons of ore yielding $64,755 gross and net $26,168. Construction expenses were $5405; operating, $38,586. The ore averaged $3.46 per ton.

Arizona

Gila County

Miami—The company is maintaining a production of 85 tons of concentrates per day, averaging 41 per cent. copper with the mining and milling of 1900 tons of ore per day. Four of the six sections of the mill are in continuous operation; the starting of the fifth section may be delayed a few days on account of the non-arrival of the shafting. In the mine the mat of square sets next to the capping is crushing as anticipated and the capping is beginning to cave, as evidenced by cracks opening up on the surface at several points. The 420-ft. level is the first and at present the only tramming level. Two more concentrate tanks, each of 125 tons capacity, are being erected. This will make a total of eight tanks with total capacity of 1000 tons. A small dam has been started at the pumping station at Burch for increasing the water-storage capacity. The third Nordberg 1200-kw. generator set is arriving and is being installed in the power house.

Inspiration—Underground work has not yet been resumed. A pipe line is being laid in Webster gulch for the domestic water supply. Engineers are at work on plans for the blocking out of the orebody preparatory to mining. A small diverting dam is being built at Wheatfields so that the bed of Pinal creek may be tested for foundations of the proposed large dam. Surveys are being made for a telephone line from the dam site to the mine, a distance of 18 miles. C. H. Repath is consulting engineer. F. J. Brule, assisted by H. J. Wallace and W. C. Holman, engineers previously associated with Mr. Repath in the construction of the Tooele and the Mason Valley smelteries and other large plants, will be in direct charge of the work.

Southwestern Miami—This company, adjoining the Live Oak, is operating one churn drill. Hole No. 1 is down 1020 ft. and is being reamed to larger size. The formation thus far passed through is similar to that penetrated by the Live Oak drills.

Summit—The mine, closed down last week, is still idle. Three men remain to keep the water out and watch the property. No statement has yet been made to the shareholders.

Globe Western—This company, which suspended work two weeks ago, owing to financial difficulties, has not yet resumed, though efforts are being made to raise more money.

Barney—Assessment work is being done on the 26 claims owned by the Barney Copper Company and adjoining the Live Oak on the west and northwest. It is expected that shaft sinking will be resumed in December.

Old Dominion—The shaft timbering and headframe of the Kingdon shaft of the Old Dominion mine were completely destroyed by fire last week. The shaft burst into flame a few minutes after a round of holes was fired, 40 ft. below the tenth level, and in five hours was burned out from top to bottom. It is still too hot to determine whether it has caved at any point. All drifts leading to it have been bulkheaded. It was not being used for the extraction of ore and the output, which was temporarily decreased because of the smoke and gas, has now resumed its normal figure.

Copper Reef—The mine, 12 miles south of San Carlos, is employing 20 men. The inclined shaft is being sunk and is reported to be about 700 ft. deep. It is purposed to develop two veins from this shaft and crosscutting is in progress on the sixth level both north and south from the shaft. No ore is reported yet on this level. The property consists of 80 claims and is traversed for a distance of 4000 ft. by five veins with prominent outcrops showing considerable copper in the form of carbonates. John W. Gillingham, of Los Angeles, is general manager and Charles T. Martin, of Globe, is managing director. A special meeting of the directors was recently held in Pittsburg, but no results were made public.

Superior & Boston—The McGaw shaft is now below the twelfth level. A sump is being cut preliminary to cutting a station on that level. This is the only development work going on at present.

Arizona Commercial—The mine is still idle pending reorganization. The mine is being kept free of water and the railroad to Globe is in operation.

Calfornia

Calaveras County

Utica—This company, operating the Cross and Gold Cliff mines, at Angels, is preparing to sink the main shaft deeper in expectation of intersecting the long-lost Utica vein. Recent discoveries in other mines of the company and adjoining properties, indicates that the vein exists below the fault.

Inyo County

Skidoo—During September, 1599 tons of ore were milled, yielding $19,097 gross and net $10,037. Operating expenses were $8490, and $568 were expended on development work.

Nevada County

St. Gothard—The company is said to have decided to extend its lower adit an additional 100 feet.

Gaston—Thirty stamps are operating and the remaining ones are ready to go into commission. A sawmill has been installed and a three-story bunk house erected. Claude Ferguson is manager.

Oakman—A five-stamp mill is contemplated for this and the Sunshine mine. Frank Dillon is manager.

PLACER COUNTY

Rubelin—It is reported that the mine in the Last Chance district, has been acquired by C. T. Snedeker and associates of Chicago. Development will be pushed vigorously and a new mill and other equipment is contemplated.

PLUMAS COUNTY

Haskell Peak—It has been decided to continue the operation of this mine, near Clio. E. I. West has been appointed manager.

SACRAMENTO COUNTY

Natomas—An unconfirmed despatch states that Natomas dredge No. 9 has been destroyed by fire. It is said that the blaze originated in the oil power switch, rendering it impossible to operate the electrically controlled fire pumps with the result that the boat was burned to the water's edge. The dredge was the latest of this fleet to go into commission.

SAN BERNARDINO COUNTY

G. W. Lane, of San Jose, has taken a purchase bond on the placer ground owned by Byrne Kuffle, Blue & Nosser, near Atolia. It is reported that the installation of a dry-washer plant is contemplated.

Leland—Fifteen men are employed in new development work at this mine, near Needles, under bond to S. R. Porter, after an idleness of several years. There is a narrow-gage railroad from the mine to the Colorado river.

SIERRA COUNTY

Tightner—The new mill, recently installed on this property, has started crushing the rich ore on the mine dump.

Sixteen-to-One—The funds necessary for development of this mine have been secured by W. I. Smart, of Alleghany, and work will be resumed at once.

Nugget Nell—This placer property has been bonded by its owners, James McGregor and associates, to J. C. Steele, of San Francisco; work will start soon and will be continued through the winter.

SISKIYOU COUNTY

Osgood—A force of eight men have been developing these nine claims in Humbug gulch. The erection of a mill is contemplated.

Spring Gulch—The company has struck a 4-ft. vein assaying well in gold.

Elk Creek—The company, with property situated 2½ miles from Yreka, is preparing to crush ore as soon as the water supply will permit.

TUOLUMNE COUNTY

Black Oak—The north drift on the 15th level is reported to have opened the vein for about 375 ft., with a width of 4 ft. On the 14th level the vein has been drifted on for 150 ft. Improvements in the mill and cyanide annex are contemplated to increase capacity to 100 tons per day. R. C. Knox is superintendent.

App—A cave-in at this old mine is said to threaten the town of Quartz with destruction. At the climax of the collapse a yawning hole appeared in the surface of the earth, 200 ft. wide, 300 ft. long and 150 ft. deep. This is increasing in size. It is said to be the most extensive cave-in in the history of California mining. All the northern workings of the mine are reported to have collapsed from the surface to the 10th level. Owing to the preliminary rumblings and tremors, the miners, numbering 42, made a hasty exit.

YUBA COUNTY

Summit Hill—The company, in which the Lillenthals, of San Francisco, are interested, has 25 men at work; a tunnel is being driven and surface structures erected. Machinery is being shipped in and sinking of a shaft is planned.

Colorado

CLEAR CREEK AND GILPIN COUNTIES

Corydon—This mine, owned by Senator Teller and his associates, has been idle for 20 years. Lately a local syndicate of miners was formed to lease it and in retimbering some of the old workings ore was found back of the 200 level that has given shipping returns of $120 per ton in gold. The shaft which is 600 ft. deep, will be unwatered at once.

Pittsburg—Shipments from this mine in the Russell district show returns of about 14 oz. gold per ton for first class, about 8 oz. gold for second class, about 15 per cent. of copper and some silver. This ore comes from the 800 level. The mine is noted for its production of high-grade ore.

Hubert—This mine, idle for years, has been drained by the Newhouse tunnel and is now shipping 15 tons of ore per month, averaging about $40 per ton and 40 tons of mill ore per day. H. C. Bolsinger is manager.

CRIPPLE CREEK DISTRICT

Portland—A statement issued by the company is to the effect that during three months ended Sept. 30, the new mill at the mine treated 29,559 tons of ore at a net profit of $33,110; the net profit from the mill during the first nine months of the year was $100,939.

Midget Bonanza—Carr & Co., lessees on a block of the ground owned by this company, are shipping good mill ore through the Gold Hill tunnel.

Doctor-Jackpot—The output of the Ingham mine for last month was 12 cars of mill ore. The orebody is said to be 20 ft. in width, and the ore is shipped as broken.

Pharmacist—This mine has been put in shape and opened up for leases after long idleness; the blocks of ground are being taken rapidly. This mine was the first dividend payer in the Cripple Creek district about 20 years ago. Thomas Ward is manager.

Golden Cycle—It is reported that the company has sold the Henry Adney, Mary Nevin, Rose Nicol and Maid of Orleans properties to Martin Mullen, of Cleveland, N. S. Leopold, of Chicago, and their associates. Shafts will be sunk to 1000 ft. and the mines thoroughly explored. M. B. Burke is manager.

Stratton's Independence—Cable advices state that during September production amounted to 2299 tons averaging $17.54 per ton. Low-grade mine and dump ore amounting to 10,500 tons was milled. Net profit was $11,555; special development, $965.

LAKE COUNTY—LEADVILLE

The Stevens shaft of the Iron Silver Mining Company, which has been idle for many years, has been started up again, and will be unwatered and sunk deeper; an electric hoist is now being installed. The same activity and resuscitation is being shown in many other mines, including the Miami in California gulch, which has long been idle, and where an electric hoist is being installed; the Alps No. 1, South Evans district; the McCarty lease, Resurrection No. 1, and the Progressive shaft, North Fryer hill, in all of which operations are being resumed.

PITKIN COUNTY

Since the unwatering of the Free Silver shaft at Aspen and the installation of an electric hoist, the property has been worked to full capacity, producing about 6000 tons per month, but with the present equipment it has not been possible to move the large bodies of low-grade ore quickly enough to return a profit; plans are now under way to abolish the mule-tram system and to install an electric plant to do all the work. Under a more economic system it is believed that the large bodies of silver-lead ore can be made to pay. W. W. Davis is general manager and John R. Champion is superintendent.

SAN JUAN DISTRICT

Conditions in Telluride are now better than for many years. The Liberty Bell mill is treating 500 tons per day, the Tomboy mill 400 tons, the Smuggler Union 250 tons, and the smaller plants about 100 tons each; these mills are said to be equipped with the most uptodate machinery available.

Camp Bird—The mine, which made a profit of about $380,000 for the quarter, May 1 to July 31, is said to be nearing the end of its reserves of ore and it is highly probable that before long operations on company account will cease and the property will be leased. The future policy will be decided on at the meeting to be held in London on Oct. 30.

Idaho

Coeur D'Alene District

Callahan—The raise, which was started some time ago from the lower tunnel, has broken into the level above. This raise is 400 ft. long and opens two new levels. The ore encountered was of a better grade than the ore in the upper workings. An additional force of men will be put to work, as the new stoping ground opened up will allow of a greater production. The company has let a contract to haul the ore four miles to Bunn Station. From there the ore will be shipped by rail.

Snowstorm Extension—This property, northeast of the famous Snowstorm mine, is being stocked with rails, pipe and general supplies for the winter's work. Two shifts are working steadily and the development will be carried on all winter. Several dikes, heavily mineralized with lead, have already been cut and these, when followed, are expected to lead to ore. At present the work is all being done in the tunnel.

Caledonia—The work on the long tunnel has been started on this property. The portal is on Bunker Hill & Sullivan ground, near the town of Kellogg. The tunnel when completed will, besides giving additional stoping ground, eliminate the long haul of supplies into and ore out of the mine.

Massachusetts

A company is being formed to develop a pyrites property, situated on the Fowler farm in Williamstown. It is stated that leases have been obtained for 99 years. H. S. Bicknell and Charles A. Jones, of North Adams, are interested.

Michigan

Copper

Indiana—Sinking is progressing satisfactorily. Copper was encountered in No. 9 vertical drill hole, near and parallel to the shaft, at depths of 575, 617 and 883 ft., and the intention is to explore the ground near the shaft at these levels by crosscutting. The recent assessment is to provide funds for this.

Allouez—No. 2 shaft is being equipped with a permanent surface equipment, consisting of a new steel rockhouse, and a high-duty engine, bought from the Tamarack company. The property is rounding into shape nicely and undoubtedly will be the next mine of the district to enter the dividend-paying ranks.

Superior—All drifts north of No. 1 shaft are being extended to the boundary lines to allow the working of the lode at the most distant points. The ground is broken and highly mineralized.

Osceola—It is said that the old Osceola branch, shut down 18 months ago, will soon resume.

Isle Royale—Development work tributary to a shaft on the Baltic lode, has been curtailed, but a small force of men is still at work, it being deemed advisable to await further developments of adjoining properties, particularly the Houghton Copper Company. At the main mine, openings are being extended and put in shape so that production can be materially increased as soon as conditions warrant.

Hancock—It is reported that production, which has been in progress for several months to test the lode, will soon cease. Efforts will be confined to sinking the large shaft which has attained a depth of 3000 ft. and has 600 ft. yet to go before encountering the Pewabic lode, the original objective point.

Lake—W. A. Paine is reported as saying that the bottom levels are looking better than at any point above and that stoping ground is being created as rapidly as conditions will permit. The new rock house will permit production of 2000 tons per day. The new shaft has been holed through from surface to the eighth level and is sinking to the ninth level.

Iron

Champion—A cave-in occurred recently at the old No. 2 workings. Two of the old buildings went down and a large area fell away, extending to within about 20 ft. of the railroad track leading to the mine buildings. The underground workings now in operation were not damaged.

Imperial—All underground mining has ceased at this property, west of Michigamme. A steam shovel has been started on the east stockpile and 60,000 tons will be shipped.

Cleveland-Cliffs—Excellent progress is being made on the work at the power plant on the Carp river. The wooden portion of the pipe line is being put together on the ground.

Republic—The mine operated by the Cambria Steel Company, on the Marquette range, has not been worked to capacity this season. It has been shipping steadily and the stockpile has been considerably reduced.

Chapin—The mine, the largest on the Menominee range, has been operated on a reduced scale all season. Recently a steam shovel has been put to work on the large stockpiles at the Ludington shaft.

Groveland—Work at this Huron Mining Company's mine indicates that the ore improves with depth and that the deposit is large.

Florence—This company is operating a drill in S. 27—T. 43—R. 35, one mile west of Iron River.

Jones & Laughlin—The company is preparing to open a mine in S. 14—T. 43—R. 35, 1½ miles north of Iron River.

Minnesota

Cuyuna Range

Kennedy—This Rogers-Brown mine is at present employing about 225 men and expects to stock-pile about 130,000 tons of ore during the coming winter.

Barrows—This M. A. Hanna property, south of Brainerd, is pushing developments rapidly. The shaft which is in as poor ground for sinking as any in the district, is now down over 60 ft. I. S. Roe is in charge of the work.

Mesabi Range

The mines in the vicinity of Eveleth are rapidly getting their stock piles cleaned up and it is expected that by November 15 the shipping will cease. According to report the Duluth, Missabe & Northern railroad will cease shipping by Nov. 10 or 12 this season, while the Great Northern railroad will operate until Nov. 20.

Hawkins—This mine, at Nashwauk, controlled by the International Harvester Company, is installing a washing plant about two miles southeast of the property. This is the second concentrating plant to be installed on the Minnesota iron ranges. From present indications it is believed that other similar plants will be installed in the next few years. A large generator is being installed at the power plant of the concentrator, which will supply power to the shops, to the concentrating plant itself and to the mine. It will also supply light to the offices, residences, etc.

St. James—This mine, at Aurora, which the Corrigan McKinney Company owns, will start operations again. The mine has been shut down for four years, but will start pumping operations immediately; pumps have been sent over from the St. Paul mine at Keewatin, Minn., for that purpose.

Adriatic—The mine, at Aurora, closed down indefinitely on Oct. 14. About 200 men were employed, working both day and night shifts.

Murphy, Dorr & Flynn—It is reported that Cole & McDonald who are drilling this property for the fee owners, have found ore. Five holes have been drilled.

Montana

Butte District

North Butte—The shaft of the Speculator mine, according to the report for the quarter ended Sept. 30, was sunk 65.5 ft., completing the sump required for work on the 2800-ft. level. Cutting of skip pockets on the 2600- and 2800-ft. levels has been started and a pump station has been cut near the bottom of the shaft. A small vein carrying from 6 in. to 1 ft. of 5 per cent. copper ore and apparently an offshoot of the large vein encountered in the shaft 50 ft. above the 2800-ft.

level, was struck while cutting the 2800-ft. level skip pocket. At the Granite Mountain the shaft has been completed, three compartments wide, to the 700-ft. level and connected to the Speculator workings there. The Gem shaft has been completed from the 1800-ft. level and a raise from the 2000-ft. level to connect with this shaft has advanced 46 ft. On the South Crœsus vein a raise has been driven from the 2200-ft. to the 2000-ft. level, for ventilation. The west drift on the 2200-ft. level of the Adirondack vein has been driven 225 ft. and must be advanced 200 ft. further to be under the orebody developed on the 1800-ft. level; this drift encountered a length of 25 ft. of ore 2 ft. wide, averaging 15 per cent. copper and 6.5 oz. silver. The west drift on the Bertha May vein on the 2400-ft. level disclosed a body of ore 200 ft. long, 6 ft. wide and averaging 4.1 per cent. copper, and 2.3 oz. silver. On the 2200-ft. level of the North Crœsus vein a drift has been driven east 41 ft., and crosscuts driven north and south from the face showing over a 50-ft. width of vein matter, and several streaks of ore from 2 to 5 ft. wide, assaying from 4 to 10 per cent. copper. On the 1600-ft. level the east and west drifts on the Snowball vein have disclosed a body of ore 450 ft. long, 3.25 ft. wide, averaging 6.1 per cent. copper and 6.7 oz. silver. Another orebody on this level shows ore 3 ft. wide, assaying 10.5 per cent. copper and 13.5 oz. silver. On the 1800-ft. level of this vein development has given a total orebody 400 ft. long, 5 ft. wide and averaging 6 per cent. copper and 8 oz. silver. In crosscutting on the 2000-ft. level a 2-ft. vein was cut averaging 12 per cent. copper and 17 oz. silver for a length of 75 ft. Development included 1077 ft. of crosscuts, 2316 ft. of drifts, 410 ft. of raises and 250 ft. of shaft sinking.

DEER LODGE COUNTY

Hidden Lake—The owners of the Hidden Lake group of mines in planning to work the property on a larger scale than formerly, are figuring on mining and milling 100 tons of ore per day, and by the request of the stockholders, H. E. Brillhart, local manager of the Great Falls Power Company, has made a trip to the property to obtain an estimate on the cost of running an electric power line to the mine for running the mine and mill. Harry Bacorn, former leaser of the property, is at present milling a few hundred tons of ore in the Dougherty mill, which he mined in the last few weeks of his lease.

Frankie D.—Harry A. Denny, owner of the Frankie D. claim, on Lost creek, is working a few men there and intends to increase the force soon. Mr. Denny and the Largey estate of Butte own several claims near the Frankie D., upon which negotiations for a lease are now under way by Butte men.

Georgetown Mining Company—Articles of incorporation were filed in Anaconda, Oct. 18, the directors being Charles Bostrom, Garry Nugent, Charles F. Healea, H. A. Conyne and James Pringle, all of Anaconda. The capital stock is 1,000,000 shares, par 5c., and the life of the corporation was given as 20 years.

LINCOLN COUNTY

Snowshoe—The Parific Coast Smelting, Refining and Mining Company, operating this mine, 20 miles south of Libby, Mont., is engaged in sinking the shaft from the 400-ft. level and is doing some other development work. The concentrator has been closed down temporarily on account of a shortage in the water supply, water being used for power. A series of ore shipments will be made at once, the company having just purchased 14 horses to be used in hauling the concentrates to the railroad, a distance of eight miles. The ore contains silver, lead and gold.

Nevada

CHURCHILL COUNTY

Nevada Hills—It is reported that a $20,000 shipment of bullion has been made from the new mill. The plant is now handling more than 100 tons per day with a force of four men per shift.

COMSTOCK LODE

Ophir—Complete returns on 2000 tons of ore milled at the Kinkhead mill, and ended Sept. 25, gave a net cash yield of $76,459, an increase over the previous run of $13,000. The average grade of the ore at the mill was $45.54 per ton, and the percentage of extraction obtained was 88. The company now has more than $73,000 surplus in the treasury and at the present rate of bullion output, it is likely that the first of several dividends may be declared at the annual meeting in December. The recovery from the mine last week was $22,000.

Mexican—The large ore and rock crusher for the new mill is being installed at the Union shaft hoist, and ore for the mill will be dumped into the crusher as it is hoisted from the mine. From that point it will be carried to ore chutes at the mill by means of belt conveyers. Nearly all the heavy machinery for the mill is on the ground and now being installed. The recovery from the mine last week is estimated as worth $15,000, 129 mine cars being stoped from the 2500 level and the average assay return being $116 per ton. Smeltery returns of three railroad cars of first-class ore netted the company $10,000. Ore averaging $30 per ton is being stoped from the 2300 level.

Union Consolidated—The north drift on the 2500 level from the old Patton east crosscut, cut a pay streak about 42 ft. in, and 15 cars gave returns of $30 per ton. A west crosscut is being extended from the end of the drift, all of the material last week being saved for ore. This is from an unexplored section of the mine and is considered an exceptionally promising prospect.

Crown Point—Ore worth $5200 was mined last week from the 1400 level, over 600 tons being hoisted.

NYE COUNTY

Tonopah-Belmont—Actual construction of the new mill building will be commenced this week, about 400 tons of structural steel having arrived. All concrete work of the mill plant has been completed except foundations for minor parts of the machinery. The plant will consist of 60 stamps, eight tube mills, concentrators and a complete cyanide plant, and is designed to treat 500 tons of ore per day. Otto Wurtenwiler is construction engineer.

Giroux—Plans for immediate development, outlined by President Cole, who has just visited the property, include a 1000-ton concentrator, a railroad from Bunker hill to the mill, the equipment of the Bunker Hill shaft and the stripping of the sulphide zone where it crops near the surface. Work is expected to start soon.

New Mexico

Chino—Drill holes put down by the company in the town of Santa Rita proved the presence of an orebody underlying a portion of the town; to mine this ore it will be necessary to move a part of the town.

Mistletoe—There is a persistent report in the Magdalena district to the effect that New York interests are contemplating the taking over of this property, the Magdalena Tunnel Company and the Linchburg group, at present under option to the American Zinc company. The fact that the engineers of the Miami Copper Company have looked over the above properties lends color to the rumor. There is some speculation as to what part the American Zinc company would play in any such transaction.

New Jersey Zinc Company—This company, acting through the Empire Zinc Company, is gradually acquiring extensive holdings in the vicinity of the Tribullion properties. About five years ago the company purchased 35 acres of mineral ground strategically situated as regards the Tribullion acreage at a reported price of $30,000; since then more holdings have been acquired in the same vicinity and also in the south end of the camp. Cash payments were invariably made and no development work was done on the claims.

Socorro—Considerable new equipment is being installed and operations will be enlarged.

North Carolina

Asheville Mica Company—This company, W. Vance Brown, president, has bought the lands of the Great Southern Mica Company, on the French Broad river, near Asheville. The property is to be developed by the new owner.

Oregon

Channel—This property in Josephine county has been leased to George E. Saunders, Grants Pass, who will develop it at once.

Granite Hill—This placer property Josephine county, is to be extensively worked by the owners, the Oregon Gold Mines Company, of Grants Pass.

Big Elk—Extensive preparations are being made for development work on this property near Alma, Baker county. High assay returns have been obtained. C. L. Cox, Sumpter, is owner.

South Dakota

Black Hills District

Lundberg, Dorr & Wilson—The Trojan company, which is now operating its own mill, and the suspension of operations by lessee P. H. Bertschy, cut off nearly all of the supply of custom ore which had been coming to this mill, and as a result the Lundberg, Dorr & Wilson mines are being operated more energetically than for a number of years. The mill handles about 110 tons per day.

Bismarck—Work of mill construction is going ahead at a satisfactory pace, and F. B. Hitchings, general manager, hopes to have the superstructure inclosed before snow flies. Fred Rossiter, superintendent, is rapidly getting the underground workings in shape to produce the 300 tons per day which the mill will require at the commencement of operations.

Wasp No. 2—The mill is running steadily, handling nearly 500 tons per day. The dividend just declared makes the total paid to date $285,595.

Echo—Shaft sinking from a station cut in the main tunnel is proceeding steadily. At the present time a small hoisting engine, driven by compressed air, is being used, but an electric hoist will be put in. A. J. Simmons, Deadwood, is general manager.

North Homestake—At a depth of 250 ft. below the station on the quartzite level, a station is being cut. As soon as this station is completed sinking will be resumed, it being the intention to sink at least another 100 ft. before doing lateral work. The quartzite station is 220 ft. deep, so that the shaft at present has a depth of 470 ft. L. M. Maitland, Maitland, is superintendent.

Carbonate—These properties, under lease to R. Bunce, are producing some high-grade argentiferous galena, which is being shipped to Denver smelteries.

Utah

Juab County

Scranton—This mine in Tintic has been attracting attention on account of the recent discoveries of new bodies of lead ore. The property is developed by several tunnels, the upper tunnel being known as the Biddlekon and the lowest as the Del Monte. The first of the strikes was made in a fissure paralleling the Biddlekon tunnel; several openings have been made in the vein, all showing ore, which has been followed out into the bedding planes. The new work has covered about 500 ft. along the trend of the fissure and a good tonnage is exposed. Following the above discovery, the lower winzes of the Del Monte tunnel were explored and several good bodies of ore opened in a fissure, which, if projected, will intersect the Biddlekon fissure within the next 150 to 200 ft. The ground is heavily mineralized, and the exposures already made, promise interesting results.

Swansea Consolidated—A face of lead ore of good grade has been opened on the 950-ft. level, a short distance from the shaft. Work is also being done on the 800 level.

Gold Chain—The first lot of ore has been hoisted since the installation of the new equipment and shipments will be resumed soon. A large amount of ore has been broken in various parts of the mine.

Iron Blossom—About 5900 tons were shipped in September. A diamond drill hole is being driven on the 1900-ft. level.

Lehi-Tintic—The main tunnel is in 860 ft., and progressing at the rate of 5 ft. per day. The contact, which has carbonates in the face, is being followed.

Salt Lake County

Columbus Consolidated—It is reported that since June, $8000 of the indebtedness have been canceled, leaving about $4500 to be paid; about $11,000 have been spent in pumping out the property, and in repairing the shaft. The company has paid its way. Drifting is being done both ways along the contact to two fissures, each of which will be reached in 125 to 150 ft. Conditions are promising. No official statement has been given out, however.

Utah Mines Coalition—Twenty teams are hauling ore. The last consignment of 48 tons, averaging 56 oz. silver, 30 per cent. lead and $1.40 gold, brought $43 net smeltery returns. Arrangements for uninterrupted operation and safeguarding the men during the winter are being made.

Alta Consolidated—The No. 2 west drift on the 600-ft. level has opened 2 ft. of ore, which a raise shows to be continuous along the trend and upward. Forty tons of ore from this place have been marketed. The face of the No. 2 east drift shows 1 ft. of carbonate ore of shipping grade.

Summit County

The case of the Conkling Mining Company *versus* the Silver King Coalition Mines Company has been set for trial Dec. 11. The suit alleging extraction of a large amount of valuable ore from jointly owned territory was filed Jan. 1908.

Daly West—The third quarterly report, dating from July 1 to Oct. 1, shows that there were marketed 1186 tons of crude ore bringing $11,844; 1785 tons of zinc concentrates worth $17,847, and 7591 tons of lead concentrates which sold for $187,573. The net gain, after paying a dividend of $54,000, etc., and leaving a treasury reserve, was $24,009. It is stated that the orebodies mentioned in the two reports preceding, have proved continuous. A winze sunk from the 1900- to the 2100-ft. level for ventilation and prospecting has opened an orebody, which is continuous to the northwest, and appears to be a part of the orebody on the 1900-ft. level. A drift on the 1700-ft. level, 800 ft. from the shaft on a known contact, has for 60 ft. been in a full face of ore of average grade. A large tonnage is looked for here. The company, with the Silver King Coalition and the Daly-Judge has purchased 700 acres of dumping ground at a nominal price.

Washington

Yankee Boy—The force at this mine, in Whatcom county, near Pleasant Valley, has been increased and operations will continue through the winter.

Little Michigan—Work will soon be started on this property, in Ferry county, on the 200-ft. tunnel. A. E. Wilson, Orient, has charge.

Washington Steel and Iron Company—This company, of Spokane, is considering the erection of a smelting plant, for iron ores, near Blewett, Chelan county.

Granite Hill—This property, in Josephine county, owned by the Oregon Gold Mines Company, is to be opened at once. The mine has been closed for four years. M. J. O'Grady, Grants Pass, has charge of the work.

Golconda—Some fine ore was recently encountered on this property, near Sumpter, assays showing as high as $105 per ton. Plans are being made for increasing operations. W. H. Turner, Spokane, is in charge.

Wisconsin

American Zinc Ore Separating Company—The plant at Platteville was destroyed by fire on Oct. 21. This plant was equipped with Huff electrostatic machines of 100 tons per day capacity. Actual property loss is estimated at $60,000.

Lawrence—This and the Roosevelt properties have been acquired by a Chicago company, the Universal Mining Company. R. F. Barnett, Elizabeth, Ill., is general manager.

Canada

British Columbia

Ymir Mint—Charles E. Desrosiers has sold a one-half interest in this claim on Wild Horse creek.

Greyhound—N. J. Mitchell has secured the contract for the diamond drilling on this property in Deadwood, recently bonded by the British Columbia Copper Company.

Chance—A strike is reported on this claim near Revelstoke. Work during the summer has been confined chiefly to driving a tunnel to tap a vein of gray copper ore at depth. Indications point to an enlargement of the ore-bearing area.

White & Co.—The company is said to have found free-milling ore on Waughton creek.

Ontario

Scramble—A spur line from the main line of the Canadian Pacific railway to this mine, Lake-of-the-Woods district, has been completed. Ground has been cleared for the new shaft and compressor houses. Operations will be resumed with electric power transmitted from the municipal power system at Kenora, as soon as the machinery can be installed.

St. Anthony—Instead of closing down for the winter, as has hitherto been the practice, operations will be continued at this mine at Sturgeon lake. A gold brick worth $1760 was recently turned out. The main shaft is being enlarged and the machinery for a new stamp mill is on the way. The capacity of the plant will be doubled.

Ontario—Cobalt

Ophir—Arrangements are being made to reopen this property.

Drummond—A new vein of high-grade ore, recently found on the surface, has been followed for a considerable distance and found to maintain its grade. It averages 1½ in. in width. Another good vein has been discovered running parallel, the rock between carrying some silver.

La Rose—At a meeting of the directors held in Montreal, Oct. 24, it was decided to defer any distribution among the shareholders of the surplus, amounting to about $1,500,000, until after Dec. 31, when full reports as to the condition of the mine will be laid before the shareholders.

Little Nipissing—At the annual meeting held in Toronto, on Oct. 25, the shareholders authorized the issue of 500,000 shares of preferred stock, bearing cumulative dividends of 2 per cent. per annum, to be offered to the shareholders at 20c. per share, and to be redeemable within five years at 40c. per share, together with any dividends remaining unpaid.

Nipissing—The treatment of Nipissing high-grade ores by the Butters plant having proved successful, experiments are now being carried on with a view to the erection of a 200-ton mill for the treatment of the low-grade ore by some slight alterations in the process. There are many thousands of tons of low-grade ore on the property, which might yield a substantial profit under this system. The company had on hand on Oct. 2, $549,000 in excess of the amount required for the dividend.

Ontario—Porcupine

American Goldfields—This company is getting good ore at a depth of 70 feet.

Brough—Some promising discoveries have been made lately.

Foley-O'Brian—A statement issued by the company shows that $180,000 have been spent on the property to date; the treasurer reports $144,930 cash in hand available for development purposes. General Manager Geddes states that the Foley shaft on the south end of the property is down 70 ft., and has encountered a number of small veins with ore averaging $12 per ton. The shaft will be put down to the 100-ft. level and crosscutting undertaken to tap a large vein found on the Bewick-Moreing property adjoining.

Preston-East Dome—Another discovery of free gold has been made near the Dome line.

Imperial—A large interest in this property has been purchased by Charles D. Taylor, of California.

Boston Development—Free gold has been found in surface prospecting.

Goldfields Limited—Some encouraging discoveries have lately been made on the properties of this Larder Lake company. The power plant will be completed in about six weeks, when considerable development may be expected.

Dome Extension—A vein 8 ft. in width has been discovered about 500 ft. from the shaft.

McIntyre—Good ore is being taken out of No. 4 shaft at a depth of 180 feet.

North Dome—Superintendent Nelson has reported the discovery of a large body of quartz about 100 ft. west of the new shaft.

Mexico

Chihuahua

Compañia de Artefactos de Tierra Refractaria—This company has been recently incorporated at Parral, with a capital of 25,000 pesos. The company owns a deposit of fireclay, and will manufacture brick, crucibles, bone ash and other refractory materials.

Calabacillas—At this mine in the Guadalupe y Calvo district, the barren zone has been passed through and ore found on the other side. J. Underwood is manager.

Rosario—Six Deister tables are to be installed at this mill in the Guanacevi district. Ernest Stein is manager.

Refugio—After several year's idleness work at this mine in the Minas Nuevas district is to be resumed. The shaft is being retimbered and the workings cleaned preparatory to mining. James E. Hyslop is manager.

Esmeralda—Contracts for a large compressor, double-drum hoist and boilers were recently made. The installation of this machinery will be followed by increased production.

Corina—The shipment of bullion from this mine has been delayed by the flooded condition of the Conchos river as a result of recent heavy rains. The river cannot be crossed until the water is again at normal depth.

Gibraltar—From this Naica mine 1000 tons of ore are being shipped monthly to the Torreon smeltery. Plans are being made to double this output and possibly, within two months, a further increase to 3000 tons per month will be made.

Durango

Hilario Losoya—These mines in the Los Reyes district, 60 miles southeast of San Andres de la Sierra and 195 miles southwest of Papasquiaro will be operated by a company recently formed with 1,000,000 pesos capital by Ferdinand Sustersic and associates.

El Carmen—This company is at present considering the erection of a mill in which the ore in the dumps, about 20,000 tons, will be treated. F. C. Alley is manager.

Hidalgo

Sonora y Ures—The crosscut, being driven toward the La Blanca lode, is being advanced steadily; it is now nearly 600 ft. long.

Sonora

Transvaal—It is rumored that Phelps, Dodge & Co., may purchase this property. Engineers who have been constantly in the employ of that company have examined the mine, which fact, no doubt, gives rise to the rumor.

Tesoreria—Development work is soon to be started at this mine adjoining the Cinco de Mayo in the Tigre district. A. M. Choate will be in charge.

San Lorenzo—At this mine in the Huepac district a small force of men is at work; 50 tons of gold-silver-copper ore are ready for shipment. Martin Hickson is superintendent.

Africa

Nigeria

A correspondent reports that at an alluvial tin deposit near Naraguta, between 400 and 500 men are employed. This force secures about one ton of tin concentrate per day. It is stated that the leases under which land is obtained are clumsy and expensive.

The Markets

Coal Trade Review

New York, Nov. 1—Events seem to move rather slowly in the coal trade, and the past week has not been marked by any special incidents. In the West trade continues to show only a fair average. Mild weather has generally prevailed, with the result that putting in winter stocks is still further postponed and buying continues to be chiefly for current needs. Lake trade keeps up fairly well, and the total tonnage for the season promises to be large. The West Virginia roads, whose tonnages during the summer months did not compare well with last year, are making up for the shortage by a. larger business in September and October.

In the East the seaboard bituminous trade continues rather quiet, though sales of steam coal at tidewater are improving slightly. Prices have been depressed by larger shipments of free coal, increasing the unsold stocks which have been pretty well kept down through the summer. The coastwise trade looks a little better than it has done. Off-shore and bunker trade has been good. Anthracite trade is quiet but steady.

A despatch from Winnipeg, Man., reports that terms of settlement for the long strike of the coal miners in Alberta and British Columbia have been arranged. No particulars are given.

Secretary of the Interior Fisher, in an address at Chicago this week, advocated the establishment of a leasing system for the Alaska coalfields, with the construction of railroads by the Government for their development.

British exports, nine months ended Sept. 30: Coal, 47,618,690; coke, 711,697; briquets, 1,236,582; furnished to steamships in foreign trade, 14,346,947; total fuel sold for consumption outside the United Kingdom, 63,913,916 long tons; an increase of 1,062,772 tons over last year.

IRON·TRADE·REVIEW

New York, Nov. 1—The chief topic of discussion, of course, is the suit filed by the Government for the dissolution of the Steel Corporation. So far its influence in the trade is chiefly sentimental, and it is likely to remain so for some time. Nevertheless there is a disturbing effect, the extent of which it is rather difficult to gage.

Actual observation of the movement in finished-steel products since the suit was brought does not furnish any conclusive evidence. The testimony of two large interests is that no change has been observed in the volume of orders and

Current Prices of Metal, Minerals, Coal and Stocks, Conditions and Commercial Statistics

specifications received since the event, while the testimony of another large interest is that there has been a distinct decrease in the tonnage, though hardly in the number of individual orders. On the whole, it is likely the event will give the market a little backset, but only one which it will get over shortly, for the actual business activities of the country were making the demand upon the mills for steel, and these are not likely to be altered materially. What would occur would presumably be merely a little shortening of the interval, or decrease in the tonnage in transit, so that ultimately the consuming demand would back up to as large a tonnage going to mills as would be the case without this suit.

Pig iron business is more active and here also there seems to be more disposition to place orders ahead.

The statement of the Steel Corporation showing an increase in the September quarter earnings of over 35 per cent. over those of the June quarter, confirms what has been said from time to time of the larger volume of business done. This gain has probably been greater than that in earnings, owing to the lower prices at which most of the selling was done. The unfilled orders on the books on Sept. 30 were 3,611,317 tons, a gain of 250,269 tons. The net earnings for the nine months ended Sept. 30 were $81,150,448, being less than in 1910 and 1909, but greater than in 1908. No changes were made in dividends.

United States Steel Corporation—The statement for the September quarter is as follows, earnings including the balance after deducting operating expenses and charges of subsidiary companies:

Earnings:	1910	1911
July	$ 12,132,158	$ 8,750,469
August	13,132,755	10,710,145
September	12,100,244	10,062,113
Quarter	$37,365,157	$29,522,725
Interest, sinking fund and depreciation		14,118,531
Balance, surplus		$15,404,194

From the surplus an appropriation of $12,658,700 was made for the usual dividends of 1¾ per cent. on preferred and 1¼ per cent. on common stock, leaving an undivided balance of $2,745,294. The earnings for the quarter show an increase of $7,682,845 over those of the June quarter.

Baltimore

Oct. 30—Exports for the week included 444,700 lb. galvanized steel pipe to Antwerp; 1,765,050 lb. steel billets to Liverpool. Imports included 1018 tons ferromanganese from Liverpool; 115 casks manganese ore from Hamburg; 637 tons manganese ore from Rotterdam; 27,065 tons iron ore from Cuba; 9720 tons pyrites from Huelva, Spain.

Birmingham

Oct. 30—The Southern pig-iron market is far from being active though some sales are being made, and for delivery, too, into next year. The quotations are around $10 per ton, No. 2 foundry. The make is not only being kept up but will be increased shortly, one furnace having been started up in the last fe wdays and another being ready to start. There is no accumulation of iron despite the steady make. Some sales are reported to have been made for delivery during the first six months of the coming year at current prices. The melt in the home territory continues good, the cast-iron pipe people in particular having a good line of orders in hand and many in sight. The stove makers are still operating their plants right along, while machine shops and foundries are doing fairly.

About the first of the coming year the Dimmick pipe plant at North Birmingham will be ready for operation and it is understood a large force of men will be given employment.

Discussion is on here now in the dissolution suit filed by the government against the United States Steel Corporation. Laymen do not believe that the suit and the possible dissolution of the corporation will hurt the Birmingham district. The Tennessee company it is believed, can be successfully operated as an independent concern.

The Southern scrap-iron market is dull. The charcoal iron trade is also quiet. The brass foundries are doing some work on tuyeres, jackets and other jobs, for the blast furnaces.

Chicago

Oct. 31—The iron and steel trade remains in a stagnant condition. Unquestionably in the mind of the consumer there is the idea of overproduction of basic materials, and he is justified in that belief so long as the leaders in the sell-

ing lines confess their inability to market any large amount of materials. Inquiries in several directions obtain the information that the entry of a suit for dissolution against the Steel Corporation has not affected the market; it is still in the state which natural conditions of supply and demand have created for it. This being the case, the local effect at least of the corporation's influence on the market may be considered small.

As a foundry market, Chicago is most concerned in the price of pig iron. That still remains $10 Birmingham, or $14.35 Chicago, for No. 2 Southern, and $14.50 at furnace on No. 2 Northern. Sales have been small in the last week; the average melter is buying only for his immediate needs up to the end of the first quarter. Few contracts are being made beyond the first quarter. On a large contract a decidedly lower price might be made if anyone were seeking it. A few inquiries for first-half delivery generally lend mild interest to the market; nearly all buyers and sellers are concerned in the quick-delivery business.

Neither the railroads nor the users of construction materials, the largest interests in the finished goods market, are showing much desire to buy. The railroads are holding off wherever possible and the construction lines naturally lag with the approach of cold weather. Steel bars are still selling in some instances below the Pittsburg price plus freight to Chicago, but the 1.33c. minimum obtains on most business; the lowest cut reported is to 1.18c., said to be due to the surplus again piling up at the local mills with every buying lull. Bar iron holds steadily to 1.175@1.20c., with a fair market. Sheets and plates are light sellers; wire goods continue in relatively good demand. The general impression on the selling side seems to be that the market has reached its lowest depth and that the upward tendency is foreshadowed in general conditions.

Cleveland

Oct. 30—Ore men are busy discussing the reduction of freight rates on the Mesabi roads. This takes effect Nov. 1, but will have practically no effect on this season's ore shipments; nor will it reach the furnaces until well on into next year, since they will run for half the year at least on the ore sent down this season.

Pig Iron—Sales have not been large, but there are many inquiries and shipments on contracts have increased, indicating a larger consumption of iron. Current quotations, Cleveland delivery, are $15.40 for bessemer, $13.75 for No. 2 foundry, $13 for gray forge and $17.50 for Lake Superior charcoal iron.

Finished Material—Quite a large number of small orders are coming in, and these have made up a very satisfactory total for the week. Bars are in good demand, and steel bars are now held at 1.10c. Pittsburg base. Reinforcing bars for concrete work have been freely sold.

Philadelphia

Nov. 1—The future of pig iron has been upset by the conditions relating to the cost of ore and freight rates in the West, though no immediate change is anticipated. Stocks in this territory are steadily declining. Scarcely any business has been done for next quarter and makers are not seeking such business. Inquiries are few in number and only small purchases are being made. The prospects for large business in basic are less favorable than a week or two ago. More business is being done in forge than for several weeks. Southern makers are more willing than Northern to do business relating to next year's delivery. The entire situation is complicated and the only sales reported from the Pennsylvania furnaces for early delivery are on a basis of No. 2 X for $15. Gray forge is selling at $14.50 for immediate necessities. Dealers in basic look for heavy transactions in a short time on a basis of $14.50, but give no other reason than the single one that there is more probability of basic advancing in a few weeks than declining.

Steel Billets—The improved conditions in establishments using billets accounts for some increased activity for December and January deliveries. Today selling quotations are given at $21.40@22.40 per ton.

Bars — The improvement heretofore noted in iron and steel bars continues and anything like a good order is snapped up at the lowest shading made. Orders booked today show a shading under 1.25c. for steel bars and as low as 1.20c. for iron bars.

Sheets—Sheets could be shaded on large orders, it is said, but the only business reported is in small lots.

Pipes and Tubes—In cast-iron pipe there is no complaint to be made and foundries are well supplied with work. In merchant pipe the amount of business is larger than for a few weeks past.

Plates—Quite an active demand for plates has developed in which shipyards figure largely. There is more business pending at this time than for many months growing out of pending and projected ship construction for coastwise and Panama canal service. On the average of small orders, which figure up well, the prices are not far from 1.25c. delivered.

Structural Material—Large orders for structural material have been booked on railroad account as well as for private construction requirements.

Scrap—The scrap market has dropped into unusual dullness and the accumulations in the yards, which are large, are giving the scrap dealers no concern.

Pittsburg

Oct. 31—Pittsburg sentiment in the matter of the dissolution suit brought by the Government against the Steel Corporation is mixed. In some quarters there is a feeling of relief that the uncertainty is over and the matter put into the courts for a couple of years, since it was expected by many, if not the majority, of steel men that a suit could not be avoided. The feeling of sellers of steel is that the market has been subjected to so many backsets that the bringing of the steel suit cannot greatly injure it, but at the same time it is recognized that all thoughts of a general improvement, with advancing prices, must be dismissed. There were no definite expectations of this sort for the near future, but it is distinctly depressing to have to conclude that the possibility of such a thing within a couple of years or so is not to be considered, for presumably the suit will take about that length of time to reach final settlement.

Especial interest attaches to the merchant steel-bar market at this time. Various little indications point to a possible stiffening, which it is believed would be the signal for more liberal specifications, for the country is absolutely bare of stocks, and mills are called upon to make direct shipments upon jobbers' orders in a way they could not possibly compass had they the ordinary amount of business on books. The slightest change in the market would lengthen the time of delivery and force a mass of buying to bring stocks up to a point required for the ordinary transaction of business. The flow of steel products is not in the normal channel at present.

Plates are slightly weaker, and are quotable at 1.12½@1.15c., Pittsburg, 50c. lower than a week ago, and the new quotation is subject to the same shading as old quotations, for especially desirable business. There has been a slight reduction in the competition by small mills, which find prices unsatisfactory, compared with their costs.

The reduced prices in wire products noted a week ago, $1.60 for nails and 1.40c. for plain wire, have not been held, nails being frequently sold at $1.55. Trustworthy observers think it unlikely that a general price war can be averted and further declines are likely, until some of the competition is eliminated. The excess of capacity over demand is greater in wire than in almost any other steel product.

Pig Iron—The market has been extremely quiet, but sales of 300 tons of bessemer, 200 at $14.30, Valley, and 100 tons at $14.25, Valley, have made the market quotable 25c. lower, at $14.25, Valley, which is rather farcical considering that two years ago bessemer iron was selling in lots of from 10,000 to 25,000 tons, and prices advancing 50c. or $1 at a time. Clinton furnace, the only

merchant stack in Pittsburg, is going into blast this week. The idle one of the two Detroit stacks will go into blast about the middle of November. We quote: Bessemer, $14.25; basic, $12.50; malleable, $12.50@12.75; No. 2 foundry, $13.25@13.50; forge, $12.75@13, all f.o.b., Valley furnaces, 90c. higher delivered Pittsburg.

Ferromanganese—The market is in a curious condition, there not having been enough done to establish prices, although the alinement is for a sharp advance from prices of a few weeks ago. There were free sales of prompt at $36.50, Baltimore, after the English combination was effected, and put its minimum at $38.50, Baltimore. This combination is regarded as complete, with prospects of the German producers coming in, while their price has, in any event, been above the equivalent figure. The last sale reported was the carload noted in last report, which was at $37.08, Baltimore, while the asking price for prompt and forward is $38.50, Baltimore.

Steel—The settlement price for November deliveries of bessemer sheet bars on contract is likely to be $20, maker's mill, Pittsburg or Ohio, which will be interpreted as $20, delivered in the immediate Pittsburg district. This is about 50c. below the corresponding October settlements and $2 below the market of a couple of months ago. Small lots bring 50c. or $1 more. Bessemer billets and openhearth billets and sheet bars are all quotable at about $20, Pittsburg or Youngstown, openhearth sheet bars being cut less than formerly, by reason of the withdrawal of one of the small mills.

Sheets—The market continues to show a good volume of business at prices lately ruling. We quote 1.80@1.85c. on black, 2.85@2.90c. on galvanized, and 1.35@1.40c. on blue annealed, f.o.b. maker's mill, Ohio, the lower figures being done only on the most attractive business.

St. Louis

Oct. 30—The market has been quiet and largely confined to small orders. A few speculative buys have been made during the past week and while the tonnage seems to have been greater, prices have been shaded in order to get it to moving. Some spot Southern iron has been reported as changing hands at as low as $9.50 per ton, Birmingham. Some first-quarter 1912 contracts have been reported as going at $10, consequently the prevailing figure is around $10, Birmingham, or $13.75, St. Louis, on No. 2 foundry. Some high silicon iron has been contracted for. Northern iron has been in fair demand at around $15, St. Louis.

Iron Ore Trade

Prices of Lake Superior iron ore for the season of 1911 are as follows, f.o.b. Lake Erie docks: Bessemer ore—base 55 per cent. iron and under 0.45 phosphorus—$4.50 per ton for Old Range and $4.25 for Mesabi; nonbessemer—base 51.5 per cent. iron—$3.70 for Old Range and $3.50 for Mesabi.

METAL MARKETS

New York, Nov. 1—The metal markets have been rather less active in the past week and some recession has been evident in certain lines. Wall Street has had some unfavorable effect on the markets.

Gold, Silver and Platinum

UNITED STATES GOLD AND SILVER MOVEMENT

Metal	Exports	Imports	Excess
Gold:			
Sept. 1911..	$2,352,861	$ 4,704,096 Imp.	$ 2,351,235
" 1910..	1,822,476	3,192,341 Exp.	1,269,865
Year 1911..	18,263,310	45,177,106 Imp.	26,913,796
" 1910..	55,318,081	45,682,127 Exp.	9,635,954
Silver:			
Sept. 1911..	4,941,391	4,161,706 Exp.	779,685
" 1910..	4,830,346	3,441,494 Exp.	1,388,852
Year 1911..	49,528,961	33,696,430 Exp.	15,832,531
" 1910..	41,764,743	33,257,264 Exp.	8,507,479

Exports from the port of New York, week ended Oct. 29: Gold, $75,100; silver, $925,880, principaly to London. Imports: Gold, $477,289, chiefly from Mexico and Australia; silver, $76,641, from South America.

Gold—The price of gold on the open market in London remained at the normal level, 77s. 9d. per oz. for bars and 76s. 4d. per oz. for American coin. Paris is still taking a large share of the new gold. In New York a total of $1,000,000 was taken for shipment to Canada.

A report just issued by the Royal Mint estimates the gold in circulation in Great Britain—including that held by banks—at £113,000,000. This is £13,000,000 increase since the last estimate, in 1900, and £23,000,000 increase since 1892, or 19 years ago.

Iridium—Prices are unchanged, at $65 per oz. for pure metal.

Platinum—The market remains firm, but with no change in prices. Dealers ask $46@46.50 per oz. for refined platinum and $48.50@49 for hard metal. The market abroad continues strong.

Production of platinum in the United States in 1910 is reported at 390 oz., of which 337 oz. was from California and 53 oz. from Oregon. No production was reported from the Rambler mine in Wyoming.

SILVER AND STERLING EXCHANGE

Oct.-Nov.	26	27	28	30	31	1
New York....	54⅜	54¼	54⅜	54⅜	54⅜	54⅜
London.....	25⅞	25	25 1/16	25 1/16	25 1/16	25 1/16
Sterling Ex..	4.8700	4.8700	4.8680	4.8665	4.8675	4 8685

New York quotations, cents per ounce troy, fine silver; London, pence per ounce, sterling silver, 0.925 fine.

Silver—The market during the past week has remained quiet, but steady. The impression prevails that the price is likely to remain at present level under conditions now prevailing.

Shipments of silver from London to the East, Jan. 1 to Oct. 19, reported by Messrs. Pixley & Abell:

	1910	1911	Changes
India.....	£5,517,000	£6,950,300	I. £1,433,300
China.....	1,133,500	989,700	D. 143,800
Total.....	£6,650,500	£7,940,000	I. £1,289,500

India Council bills in London brought an average for the week of 16.06d. per rupee.

Stocks of sycee and bars in Shanghai according to the last returns amounted to £3,717,000 in addition to 8,500,000 Mexican dollars, and this compares with a total of £1,907,000 and 8,170,000 Mexican dollars at this time last year.

Gold and silver movement in France, eight months ended Aug. 31:

	Imports	Exports	Excess
Gold.	Fr. 98,968,000	Fr. 122,840,000	Exp. Fr. 23,872,000
1910..	185,737,000	137,575,000	Imp. 48,162,000
Silver.	114,867,000	81,569,000	Imp. 33,298,000
1910..	104,744,000	156,235,000	Exp. 51,491,000

Imports of copper and nickel coins, 31,000 fr.; exports, 335,000 fr. this year.

Copper, Tin, Lead and Zinc

NEW YORK

Oct.-Nov.	Copper: Lake, Cts. per lb.	Copper: Electrolytic, Cts. per lb.	Tin: Cts. per lb.	Lead: New York, Cts. per lb.	Lead: St. Louis, Cts. per lb.	Zinc: New York, Cts. per lb.	Zinc: St. Louis, Cts. per lb.
26	12⅜ @12½	12.20 @12.30	41¾	4.20 @4.25	4.10 @4.12½	6.10 @6.25	5.95 @6.10
27	12⅜ @12½	12.20 @12.30	41⅛	4.20 @4.25	4.10 @4.12½	6.10 @6.25	5.95 @6.10
28	12⅜ @12½	12.20 @12.30	41⅛	4.20 @4.25	4.10 @4.12½	6.10 @6.25	5.95 @6.10
30	12⅜ @12½	12 20 @12.30	41⅛	4 20 @4.25	4.10 @4.12½	6.10 @6.25	5 95 @6 10
31	12⅜ @12½	12.20 @12.30	41¾	4.20 @4.25	4.10 @4.12½	6.13 @6.25	5.95 @6.10
1	12⅜ @12½	12.20 @12.30	41½	4.20 @4.25	4.10 @4.12½	6.10 @6.25	5.95 @6.10

The New York quotations for electrolytic copper are for cakes, ingots and wirebars, and represent the bulk of the transactions made with consumers, basis New York, cash. The prices of casting copper and of electrolytic cathodes are usually 0.125c. below that of electrolytic. The quotations for lead represent wholesale transactions in the open market. The quotations on spelter are for ordinary Western brands; special brands command a premium.

Copper—The procedure of the Government against the Steel Corporation caused buyers to withdraw pending further developments. On the other hand, small holders of copper did not wish to risk holding on to their stocks in the face of the uncertainty and reduced their prices in order to capture the little business that was offered from day to day. The large interests have maintained a firm attitude, which appears fully justified by conditions. With the first of the month, a more hopeful feeling is making itself felt, due to the favorable statistics reported from London. This would indicate that the consumption is continuing at the

LONDON

Oct.-Nov.	Copper			Tin		Lead, Spanish	Zinc, Ordinaries
	Spot	3 Mos	Best Sel'td	Spot	3 Mos		
26	55 9/16	56 3/16	59¾	190½	190	15 9/16	26¼
27	55¼	56	59⅝	186 7/8	187	15 7/16	26⅜
28	.....	.....	.....	.....	.....	.....	.....
30	55¼	56	59⅝	189	188½	15⅝	26½
31	55 1/16	56 1/8	59¾	190	189¼	15½	26⅝
1	55 1/8	56 1/16	59¾	189 7/8	187	15½	26⅝

The above table gives the closing quotations on London Metal Exchange. All prices are in pounds sterling per ton of 2240 lb. Copper quotations are for standard copper, spot and three months, and for best selected, price for the latter being subject to 3 per cent. discount. For convenience in comparison of London prices, in pounds sterling per 2240 lb., with American prices in cents per pound the following approximate ratios are given: £10 = 2.17½c.; £12 = 2.61c.; £23 = 5c.; £60 = 13.40c. ± £1 = ± 0.21¾c.

high-water mark, and consumers the world over are so poorly supplied that they cannot refrain from buying for any length of time. The close is steady at 12⅜@12½c. for Lake copper, and 12.20@12.30c. for electrolytic copper in cakes, wirebars and ingots. Casting copper is quoted nominally at 12 to 12⅛ cents.

The standard market was weak and depressed throughout the week, until rumors of favorable statistics caused an advance on Oct. 31, which made further progress upon the publication of the figures, showing a decrease of 2577 tons in the visible supply in Europe. The close is firm at £55 12s. 6d. for spot, and £56 6s. 3d. for three months.

Copper sheets are 18@19c. base, for large lots. Full extras are charged and higher prices for small quantities. Copper wire is now 13½c. base, carload lots at mill. Business is quiet.

Exports of copper from New York for the week were 4644 long tons. Our special correspondence gives the exports from Baltimore at 1428 tons.

Tin—The London market showed a sagging tendency during last week, but suddenly became firm again at the beginning of this week. The American trade, however, has not shown any interest in the happenings in London, and business here is extremely dull. The close is cabled as steady at £189 7s. 6d. for spot, and £187 for three months, while November tin is quoted at 41½c. in this market.

Exports of tin from the Straits, eight months ended Aug. 31, were: United States direct, 10,998; Great Britain, 19,616; other Europe, 4202; India, 1071; China, 221; total, 36,108 long tons, decrease of 2067 tons from last year.

Supplementing the report on Chinese tin published in the JOURNAL March 15, Consul General G. J. Anderson reports that the exports of tin from China in 1910 were 14,351,108 lb.; an increase of 4,419,333 lb. over 1909. In the first quarter of 1911 the production of tin in Mengtze was 4,234,961 lb., an increase of 657,717 lb. over 1910. Exports to the United States have been nearly double those of last year.

Lead—The market is unchanged at 4.10@4.12½c., St. Louis, and 4.20@4.25c., New York.

The London market is slightly lower at £15 10s. for Spanish lead, and £15 12s. 6d. for English lead.

Spelter—The market is rather quiet. The scarcity of near-by supplies continues, although not quite as acute as during the previous week. Consumers have not yet made up their mind to buy for future delivery, even though the metal is offered at very reasonable prices for shipment after the end of the year. The close is quoted at 6.10@6.25c., New York, and 5.95@6.10c., St. Louis.

The London market is firmer, and lower quotations have attracted a great deal of buying. As there is no decrease in the consumption, prices have readily advanced to £26 12s. 6d. for good ordinaries, and £26 17s. 6d. for specials.

Base price of zinc sheets is $8 per 100 lb., f.o.b. La Salle-Peru, Ill., less 8 per cent. discount.

Zinc dust is quoted at 7½@7¾c. per lb., New York.

Silesian Zinc Market—Paul Speier reports from Breslau, Germany, under date of Oct. 20, that the market continues strong. Quotations are 55.75 marks per 100 kg., f.o.b. works—equal to 6.02c. per lb.—for ordinary brands, and 56.75 marks for specials. Zinc sheets are unchanged. Zinc dust is in demand at 54 marks per 100 kg.—5.83c. per lb. There have been many inquiries.

Other Metals

Aluminum—Quite a number of sales have been made, and business seems to be improving. Quotations are unchanged at 18½@19c. per lb. for No. 1 ingots, New York; but the tone of the market is firmer.

Antimony—Some selling was done, on the prospect that supplies from China may be cut off by the trouble in that country. Cookson's is unchanged at 8@8.12½c. per lb.; Hallett's is 7.60@7.85c. Outside brands are higher, 6.95@7.25c. being asked for Hungarian and Chinese.

Quicksilver—Business has not much life, but prices are unchanged. New York quotation is $45 per flask of 75 lb., with the usual advance for small quantities. San Francisco, $44.50 for domestic orders and $42 for export. London price is £8 10s. per flask, with £8 7s. 6d. quoted by second hands.

Bismuth—The syndicate which controls the European production quotes 7s. 6d.—equal to $1.80—per lb. in London. In New York a quotation of $1.72 per lb. is made for metal produced from American ores.

Nickel—Large lots, contract business, 40@50c. per lb. Retail spot from 50c. for 500-lb. lots up to 55c. for 200-lb. lots. The price of electrolytic is 5c. higher.

Cadmium—The last quotation was 700@725 marks per 100 kg.—75.5@78.3c. per lb.—at works in Germany, according to quantity.

Magnesium—The price of pure metal is $1.50 per lb. for 100-lb. lots, f.o.b. New York.

Spanish Metal Exports

Exports of metals and minerals from Spain, seven months ended July 31, reported by *Revista Minera*, in metric tons:

Metals	1910	1911	Changes	
Pig and manuf. iron	27,415	27,526	I.	111
Copper	10,320	8,924	D.	1,396
Copper precipitate	9,182	9,501	I.	319
Lead	109,934	83,972	D.	25,962
Zinc	654	1,168	I.	514
Quicksilver	1,300	1,480	I.	180
Minerals				
Iron ore	5,374,183	4,871,897	D.	502,285
Manganese ore	3,406	20,942	I.	17,536
Copper ore	554,924	206,759	D.	348,167
Lead ore	1,904	1,838	D.	66
Zinc ore	73,153	84,268	I.	11,115
Pyrites, iron	880,652	1,555,859	I.	675,207
Salt	314,708	242,221	D.	72,487

Imports of phosphate of lime, 78,292 tons (68,565 in 1910); superphosphates and basic slag, 58,235 (63,804 in 1910); nitrate of soda, 25,716 (23,146 in 1910). Imports of sulphur, 7352 tons.

Zinc and Lead Ore Markets

Platteville, Wis., Oct. 28—The base price paid this week for 60 per cent. zinc ore was $44 per ton. The base price paid for 80 per cent. lead ore was weak at $52 per ton.

SHIPMENTS, WEEK ENDED OCT. 28

Camps	Zinc ore, lb.	Lead ore, lb.	Sulphur ore, lb.
Platteville	1,109,800	.....	.....
Mineral Point	627,990	.....	.....
Benton	467,020	.....	164,000
Highland	422,500	.....	.....
Galena	411,100	.....	.....
Hazel Green	205,000	100,000	.....
Dodgeville	60,910	.....	.....
Livingston	.....	80,000	.....
Cuba City	.....	167,000	.....
Shullsburg	.....	87,500	.....
Linden	.....	.....	65,650
Total	3,304,320	404,500	229,650
Year to date	126,029,209	7,798,375	24,927,450

Shipped during week to separating plants, 1,620,780 lb. zinc ore.

Joplin, Mo., Oct. 28—The high price paid for zinc sulphide ore was $48 per ton, the open-market assay price of 60 per cent. zinc, ranging from $42 to $45, with the contract base price at $47.20 per ton. Zinc silicate sold at $24@25 per ton of 40 per cent. zinc. The average price, all grades of zinc, was $42.32. A few bins of lead sold at $57.50 per ton, with the general market at $55@56. The added strength was occasioned by the attempt of a fourth buyer to get in the market, it being rumored that the St. Louis Smelting and Refining Company again wanted ore from here. It was the

buyer formerly purchasing for this concern who tried to purchase ore.

The Edgar Zinc Company has contracted for the 2500-ton stock of ore of the Kramer Mining Company, at Cave Springs, and is loading it for shipment to Cherryvale. This is the stock that has been held for a $50 base price. The Edgar Company has also purchased 350 tons in one bin at Miami. The American Zinc, Lead and Smelting Company is now loading out its own production, all its contract ore and an equal amount purchased on the open market at a base price of $5 per ton less than the contract base.

SHIPMENTS, WEEK ENDED OCT. 28

	Blende	Calamine	Lead Ore	Value
Webb City-Carterville	4,644,970	.....	943,560	$126,285
Joplin	3,223,980	.....	284,220	78,885
Cave Springs	808,640	.....	.....	18,600
Miami	781,430	.....	126,300	18,320
Alba-Neck	776,000	.....	.....	17,460
Galena	330,120	78,210	254,160	15,260
Jackson	557,140	.....	.....	11,978
Duenweg	420,600	85,760	.....	10,242
Carl Junction	429,910	.....	.....	9,888
Granby	200,500	369,450	19,090	8,750
Sarcoxie	329,120	.....	.....	6,911
Oronogo	190,780	.....	56,600	5,244
Spurgeon	97,410	138,400	30,370	5,005
Saginaw	.....	51,330	25,240	1,454
Badger	60,370	.....	.....	1,260
Totals	12,850,970	723,150	1,740,140	$335,542

10 mos. .. 410,899,770 29,910,950 73,483,940 $10,792,768
Blende val., the week, $277,133; 10 mos., $8,238,954
Calamine, the week, 10,129; 10 mos., 465,010
Lead value, the week, 48,280; 10 mos., $2,088,804

MONTHLY AVERAGE PRICES

Month	Zinc Ore				Lead Ore	
	Base Price		All Ores		All Ores	
	1910	1911	1910	1911	1910	1911
January	$47.31	$41.85	$45.16	$40.55	$56.99	$55.68
February	40.69	40.21	39.47	39.16	53.64	54.46
March	43.60	39.85	39.71	38.45	51.26	54.57
April	41.00	38.88	39.33	37.47	49.72	56.37
May	40.19	38.25	37.51	36.79	48.16	55.21
June	40.20	40.50	37.83	38.18	48.80	56.49
July	39.63	40.75	36.80	38.36	48.59	58.81
August	40.13	42.50	37.32	41.28	49.75	60.74
September	43.45	42.63	39.96	41.29	54.73	59.33
October	43.31	42.38	40.50	40.89	53.18	54.72
November	47.20	.....	43.20	.....	54.80	.....
December	42.50	.....	40.70	.....	55.70	.....
Year	$42.43	.....	$39.79	.....	$52.12	.....

NOTE—Under zinc ore the first two columns give base prices for 60 per cent. zinc ore; the second two the average for all ores sold. Lead ore prices are the average for all ores sold.

CHEMICALS

New York, Nov. 1—General business continues fair, but shows no special activity.

Copper Sulphate—On a moderate trade prices are unchanged, at $4.50 per 100 lb. for carload lots, and $4.75 per 100 lb. for smaller parcels.

Nitrate of Soda—Business in this article is good and the market is very firm. Current quotations are 2.25c. per lb. for spot and for futures up to Dec. 31; and 2.22½@2.25c. for all positions next year.

Arsenic—The market is stronger, although few sales are reported. Current supplies are not heavy. Prices remain firm at $2.12½@2.25 per 100 lb. for spot lots of white arsenic. Futures are irregular.

Chromates—It is stated that a factory is to be erected at Norfolk, Va., which will have a yearly capacity of 6000 tons of bichromate of soda and 2000 tons of bichromate of potash. It is said that English capital is interested and that the new concern will be entirely independent of the Mutual Chemical Company, which now has a practical monopoly of the bichromate trade.

MINING·STOCKS $

New York, Nov. 1—The chief excitement of the week on the general stock markets was the opening of the government suit against the Steel Corporation. Although the effect of such a proceeding had been discounted to some extent, the immediate result was a sharp drop of over 8 points in Steel common. All the other industrials declined in sympathy. After a short period of excited selling, however, Steel common rallied and by the end of the week had recovered more than half the drop. Other stocks improved also, and the market closes with rather a firm tendency.

There was one sale of Homestake recorded, 200 shares changing hands at $84.50 per share.

On the Curb mining stocks were not especially active. The Curb did not quite follow the Exchange, but business dragged a little, and stocks were not strong. Dealings in the copper shares were moderate, and with only small changes in quotations. Cobalts were inclined to weakness and were generally lower. Porcupine stocks were dealt in, but aroused no enthusiasm. Other mining stocks were quiet.

Boston, Oct. 31—But for the weakness of Amalgamated and American Smelting in New York, copper stocks would give a better account of themselves in this market. The local list is somewhat uneven but on the whole a good tone is manifest and it would not take any great amount of buying to give coppers quite an uplift.

Trading is desultory and there is an entire lack of enthusiasm. Calumet & Hecla stocks were weak for a spell, but have come back again. Calumet & Hecla broke $15 to $375 per share, but subsequently recovered it in full. Superior Copper broke $4 to $19.50 on unfounded reports of a forthcoming assessment. Of this break $2 has been since recovered.

Greene Cananea maintains a firm tone as do Lake and North Butte. The stocks have been the most active ones of the list. Superior & Boston is selling at $3.50, assessment paid.

Trading on the Curb has also been light with the greatest activity in the cents stocks. The Porcupine issues continue to show a strong tone.

The Arizona Commercial Copper Company's reorganization committee has

COPPER PRODUCTION REPORTS.
Copper contents of blister copper, in pounds.

Company	July	August	Sept.
Alaska shipments	4,678,637	2,095,690	.....
Anaconda	21,900,000	22,500,000	21,565,800
Arizona, Ltd.	2,750,000	2,720,000	2,544,000
Balaklala	.....	.....	.....
Copper Queen	6,373,062	7,006,097	6,546,540
Calumet & Ariz.	4,394,000	4,650,000	4,198,000
Detroit	1,590,357	2,080,100	1,864,050
East Butte	847,000	854,000	1,134,000
Mammoth	1,598,082	.....	.....
Nevada Con.	5,258,582	5,249,515	5,328,983
Old Dominion	2,114,000	1,982,000	2,032,000
Shannon	1,150,000	1,442,560	1,550,080
South Utah	254,462	269,546	.....
United Verde*	3,000,000	2,500,000	.....
Utah Copper Co.	7,555,407	9,010,669	9,285,381
Lake Superior*	17,060,000	19,000,000	18,500,000
Non-rep. mines*	16,800,000	.....	.....
Total production	97,263,589	.....	.....
Imports, bars, etc.	20,999,078	22,798,151	.....
Total blister	118,362,667	.....	.....
Imp. in ore & matte	4,205,940	9,821,942	.....
Total	122,568,607	.....	.....
Brit. Col. Cos.:			
British Col. Copper	854,122	736,515	875,023
Granby	1,228,846	.....	.....
Mexican Cos.:			
Boleo	1,973,680	2,149,028	2,094,400
Cananea	3,994,000	.....	.....
Moctezuma	2,340,404	2,263,707	2,112,683
Other Foreign:			
Cape Cop., S. Africa	.....	.....	.....
Spassky, Russia	672,000	649,600	759,360
Exports from:			
Chile	7,168,000	4,032,000	.....
Australia	7,056,000	7,392,000	.....

Figures are reports received from companies, unless otherwise stated. Boleo copper does not come to American refiners.
*Estimated.

STATISTICS OF COPPER

Month.	United States Product'n.	Deliveries, Domestic.	Deliveries for Export
X, 1910	126,469,284	67,814,172	68,186,912
XI	119,353,463	60,801,992	67,424,316
XII	123,339,219	43,594,018	88,104,075
Year 1910	1,452,122,120	749,426,542	722,431,494
I, 1911	115,696,591	42,078,567	53,208,739
II	109,828,297	50,518,998	45,111,019
III	130,532,080	66,080,789	59,081,127
IV	118,085,223	52,407,650	62,129,599
V	126,962,544	64,543,963	61,978,557
VI	124,554,312	61,655,561	71,460,519
VII	112,167,934	56,982,582	74,880,658
VIII	125,493,667	59,936,364	69,855,660
IX	115,588,950	57,311,584	50,824,011
X	.....	.....	.....

VISIBLE STOCKS.

	United States.	Europe.	Total.
XI, 1910	139,261,914	198,060,800	337,322,711
XII	130,389,069	193,200,000	323,589,095
I, 1911	122,030,195	236,629,120	358,649,373
II	142,439,490	236,992,000	379,431,134
III	156,637,770	233,385,600	390,023,009
IV	162,007,934	223,014,400	385,022,434
V	165,555,908	212,284,800	377,840,708
VI	165,995,932	202,540,800	368,536,732
VII	157,434,164	195,932,800	353,366,964
VIII	137,738,858	191,891,840	329,630,698
IX	133,441,501	191,228,800	324,670,301
X	140,894,856	191,945,600	332,840,456
XI	.....	.....	.....

Figures are in pounds of fine copper. U. S. production includes all copper refined in this country, both from domestic and imported material. Visible stocks are those reported on the first day of each month, as brought over from the preceding month. From Jan. 1, 1911, stocks at Hamburg and Rotterdam are included in the visible stocks for Europe.

named its board of directors, which includes three of its own members. Charles S. Smith, of the Old Dominion Company, has been named as president, as N. L. Amster expressed a desire to be relieved from the management.

Assessments

Company	Delinq	Sale	Amt
Andes, Nev.	Nov. 2	Nov. 28	$0.05
Cedar Talisman, Utah	Nov. 9	Nov. 28	0.005
Challenge, Nev.	Nov. 21	Dec. 12	0.05
Copper Mountain, Ida.	Nov. 1	Dec. 1	0.002
Gould & Curry, Nev.	Oct. 23	Nov. 15	0.05
Highland, Utah	Oct. 25	Nov. 25	0.01
Indiana, Mich.	Nov. 1	.....	1.50
Kinsley Development, Utah	Nov. 20	Dec. 11	0.002
Mayflower, Mich.	Oct. 16	.....	1.00
Montana-Bingham, Utah	Oct. 20	Nov. 10	0.01
Mountain Dell, Utah	Oct. 24	Nov. 14	0.01
New York-Bonanza, Utah	Nov. 7	Nov. 28	0.02
Pioche Metals, Utah	Nov. 20	Dec. 11	0.005
Savage, Nev.	Nov. 23	Dec. 14	0.10
Savanna, N. M.	Nov. 1	.....	5.00
Seg. Belcher, Nev.	Nov. 2	Nov. 27	0.05
Seven Troughs, Nev.	Oct. 20	Nov. 20	0.002
Sheridan, Ida.	Oct. 20	Nov. 20	0.001
Sierra Nevada, Nev.	Oct. 28	Nov. 21	0.10
Springville, Ida.	Oct. 20	Nov. 20	0.002
Superior & Boston, Ariz.	Oct. 16	.....	0.50
Swansea, Utah	Nov. 13	.....	0.01
Torino, Ida.	Oct. 27	Nov. 27	0.001
Treasure, Cal.	Oct. 12	Nov. 4	0.05
Union Con., Nev.	Nov. 27	Dec. 19	0.15
Victoria, Mich.	Aug. 21	.....	1.00
Winona, Mich.	Nov. 10	.....	1.00
Wonderful, Ida.	Oct. 30	Nov. 18	0.002

Monthly Average Prices of Metals

SILVER

Month	New York			London		
	1909.	1910.	1911.	1909.	1910.	1911.
January	51.750	52.375	53.795	23.843	24.154	24.865
February	51.472	51.534	52.222	23.706	23.794	24.081
March	50.468	51.454	52.745	23.227	23.690	24.324
April	51.428	53.221	53.325	23.708	24.483	24.595
May	52.905	53.870	53.308	24.343	24.797	24.583
June	52.538	53.462	53.043	24.166	24.651	24.486
July	51.043	54.150	52.630	23.519	25.034	24.286
August	51.125	52.912	52.171	23.588	24.428	24.082
September	51.440	53.295	52.440	23.743	24.567	24.209
October	50.923	55.490	53.340	23.502	25.596	24.594
November	50.703	55.635	. . .	23.351	25.680	.....
December	52.226	54.428	.....	24.030	25.160	.....
Total	51.502	53.486	.....	23.706	24.670	.....

New York quotations, cents per ounce troy, fine silver; London, pence per ounce, sterling silver, 0.925 fine.

COPPER

	New York				London, Standard	
	Electrolytic		Lake			
	1910.	1911.	1910.	1911.	1910.	1911.
January	13.620	12.295	13.870	12.680	60.923	55.604
February	13.332	12.256	13.719	12.611	59.388	54.970
March	13.255	12.139	13.586	12.447	59.214	54.704
April	12.733	12.019	13.091	12.275	57.238	54.035
May	12.550	11.989	12.885	12.214	56.313	54.313
June	12.404	12.385	12.798	12.611	55.310	56.368
July	12.215	12.463	12.570	12.720	54.194	56.670
August	12.490	12.405	12.715	12.634	55.733	56.264
September	12.379	12.201	12.668	12.508	55.207	55.253
October	12.553	12.189	12.788	12.370	56.722	55.176
November	12.742	.....	12.914	.....	57.634	.....
December	12.581	.....	12.863	.....	56.769	.....
Year	12.738	.....	13.039	.....	57.054	.....

New York, cents per pound. London, pounds sterling per long ton of standard copper.

TIN AT NEW YORK

Month	1910.	1911.	Month	1910.	1911.
January	32.700	41.256	July	32.695	42.400
February	32.920	41.614	August	33.972	43.319
March	32.403	40.167	September	34.982	39.755
April	32.976	42.185	October	36.190	41.185
May	33.125	43.115	November	36.547	.....
June	32.769	44.606	December	38.199	.....
			Av. Year	34.123	.....

Prices are in cents per pound.

LEAD

Mohth	New York		St. Louis		London	
	1910.	1911	1910.	1911.	1910.	1911.
January	4.700	4.483	4.582	4.334	13.650	13.009
February	4.613	4.440	4.445	4.266	13.328	13.043
March	4.459	4.394	4.307	4.238	13.063	13.122
April	4.376	4.412	4.225	4.262	12.641	12.889
May	4.315	4.373	4.164	4.223	12.550	12.984
June	4.343	4.435	4.207	4.292	12.688	13.260
July	4.404	4.499	4.291	4.397	12.531	13.530
August	4.400	4.500	4.290	4.406	12.513	14.026
September	4.400	4.485	4.289	4.356	12.582	14.744
October	4.400	4.265	4.271	4.139	13.091	15.332
November	4.442	.....	4.314	.....	13.217	.....
December	4.500	.....	4.363	.....	13.197	.....
Year	4.446	.....	4.312	.....	12.920	.....

New York and St. Louis, cents per pound. London, pounds sterling per long ton.

SPELTER

Month	New York		St. Louis		London	
	1910.	1911.	1910.	1911.	1910.	1911.
January	6.101	5.452	5.951	5.302	23.350	23.887
February	5.569	5.518	5.419	5.368	23.188	23.276
March	5.637	5.563	5.487	5.413	23.031	23.016
April	5.439	5.399	5.289	5.249	22.469	23.743
May	5.191	5.348	5.041	5.198	22.100	24.375
June	5.128	5.520	4.978	5.370	22.094	24.612
July	5.152	5.695	5.002	5.545	22.406	25.006
August	5.279	5.953	5.129	5.803	22.800	26.801
September	5.514	5.869	5.364	5.719	23.165	27.750
October	5.628	6.102	5.478	5.951	23.900	27.256
November	5.976	.....	5.826	.....	24.083	.....
December	5.624	.....	5.474	.....	24.019	.....
Year	5.520	.....	5.370	.....	23.050	.....

New York and St. Louis, cents per pound. London, pounds sterling per long ton.

PIG IRON AT PITTSBURG

	Bessemer		Basic		No. 2 Foundry	
	1910	1911	1910	1911	1910	1911
January	$19.90	$15.90	$17.98	$14.40	$17.94	$14.75
February	18.96	15.90	17.21	14.50	17.38	14.81
March	18.53	15.90	16.93	14.65	17.00	14.96
April	18.28	15.90	16.84	14.65	16.75	15.00
May	17.10	15.90	15.94	14.30	16.18	14.72
June	16.52	15.90	15.60	14.06	15.53	14.56
July	16.40	15.90	15.40	14.03	15.40	14.53
August	16.09	15.90	14.89	14.00	15.16	14.47
September	15.92	15.90	14.73	13.57	14.93	14.40
October	15.90	15.43	14.05	13.44	14.88	14.34
November	15.84	.....	14.26	.....	14.78	.....
December	15.90	.....	14.15	.....	14.65	.....
Year	$17.10	.....	$15.65	.....	$15.83	.....

STOCK QUOTATIONS

COLO. SPRINGS Oct. 31

Name of Comp.	Bid.
Acacia	03½
Cripple Cr'k Con.	.02¼
C. K. & N.	.10
Doctor Jack Pot	.04½
Elkton Con.	.61½
El Paso	.50½
Findlay	‡.05
Gold Dollar	.14
Gold Sovereign	.02½
Isabella	.08½
Jack Pot	.05
Jennie Sample	.05
Lexington	‡.01
Moon Anchor	.02
Old Gold	.03⅞
Mary McKinney	.40
Pharmacist	.02
Portland	.85
Vindicator	.64
Work	.02

SALT LAKE Oct. 31

Name of Comp.	Bid.
Beck Tunnel	.16½
Black Jack	.09½
Carisa	‡.15
Cedar Talisman	.02½
Colorado Mining	.27
Columbus Con.	.29
Daly Judge	‡4.12½
Grand Central	.97
Iron Blossom	.98
Little Bell	‡.35
Lower Mammoth	.03
Mason Valley	7.50
May Day	.10
Nevada Hills	‡2.70
New York	‡.05⅞
Prince Con	‡.64
Silver King Coal'n	1.80
Sioux Con.	.14
Uncle Sam	.27
Yankee	13

TORONTO Oct. 31

Name of Comp.	Bid	Name of Comp.	Bid
Coniagas	6.00	Pearl Lake	.40
Hudson Bay	70.00	Porcu. Gold	.45½
Temiskaming	.37½	Porcu. Tisdale	.06
Wettlaufer-Lor.	.82	Preston E. D.	.22½
Apex.	.13½	West Dome	1.12
Central	3.70	Standard	.14
Dobie	1.20	Foley O'Brien	.75
Dome Exten.	.72½	Rea	2.60
Hollinger	10.85	Coronation	.03
Imperial	.09½	Swastika	.29½

SAN FRANCISCO Oct. 31

Name of Comp.	Clg.	Name of Comp.	Bid
COMSTOCK STOCKS		MISC. NEV. & CAL.	
Alta	.04	Belmont	8.25
Belcher	.65	Jim Butler	.23
Best & Belcher	.17	MacNamara	.25
Caledonia	1.55	Midway	.28
Challenge Con.	.18	Mont.-Tonopah	.91
Chollar	.12	North Star	.29
Confidence	.55	West End Con.	.82
Con. Virginia	.77	Atlanta	.17
Crown Point	.80	Booth	.08
Gould & Curry	.12	C.O.D. Con.	.14
Hale & Norcross	.18	Comb. Frac.	.06
Mexican	3.80	Jumbo Extension	.20
Occidental	.50	Pitts.-Silver Peak	.98
Ophir	1.95	Silver Pick	.07
Overman	1.00	St. Ives	.35
Potosi	.20	Tramps Con.	.02
Savage	.16	Argonaut	2.50
Sierra Nevada	.44	Bunker Hill	‡6.50
Union Con.	1.70	Cent. Eureka	‡.75
Yellow Jacket	.45	So. Eureka	‡6.00

N. Y. EXCH. Oct. 31

Name of Comp.	Clg.
Amalgamated	52¼
Am. Agri. Chem.	48
Am.Sm.&Ref.,com	61⅛
Am. Sm.& Ref., pf.	99⅜
Anaconda	33½
Batopilas Min.	‡1⅞
BethlehemSteelpf	‡56
Chino	20⅜
Comstock Tunnel	‡.19
Federal M.& S., pf.	‡50
Goldfield Con.	4½
Great Nor., ore ctf.	42¼
Homestake	‡83
Miami Copper	19
Nat'nalLead,com.	43⅜
National Lead, pf.	‡106
Nev. Consol	16⅛
Pittsburg Coal, pf.	‡80
Ray Con.	13⅝
RepublicI&S,com	19⅜
Republic I & S, pf.	77⅜
SlossSheffi'd,com.	‡40
Sloss Sheffield, pf.	‡110¼
Tennessee Copper	34¾
Utah Copper	44⅜
U. S. Steel, com.	54⅞
U. S. Steel, pf.	105⅝
Va. Car. Chem.	46¾

N. Y. CURB Oct. 31

Name of Comp.	Clg.
Barnes King	.35
Beaver Con.	.44
Braden Copper	4⅞
B. C. Copper	4
Buffalo Mines	‡1.40
Butte & Vipond	.52
Butte Coalition	15⅛
Cobalt Central	‡.00⅝
Con. Ariz Sm.	⅝
Davis-Daly	¾
Ely Con.	1/16
Florence	.75
Giroux	4
Gold Hill Con.	‡⅜
Greene Cananea	6¾
Greenwater	.05
Guanajuato	‡3¾
Guerrero	‡1¼
Guggen. Exp.	165
Inspiration	7¾
Internat. S. & R.	‡124
Kerr Lake	3⅜
La Rose	3⅛
McKinley-Dar-Sa.	1⅞
Min. Co. of A. new	3½
Nev. Utah M. & S.	⅞
Nipissing Mines	7⅝
Ohio Copper	1⅛
Pacific Sm. & M.	1/16
Precious Metals	‡1⅝
Ray Central	1⅞
Red Warrior	‡1⅛
South Utah M. & S.	¾
Standard Oil (Old)	620
Stand'd Oil of N.J.	320
Stand'd Oil Subs.	300
Stewart	.82
Tonopah	6⅛
Tonopah Ex.	1⅛
Tri-Bullion	1/16
Tularosa	⅛
Union Mines	⅜
Union Mines	⅛
Yukon Gold	3⅜

LONDON Nov. 1

Name of Com	Clg.
Camp Bird	£1 8s 6d
Dolores	1 10 0
El Oro	1 3 0
Esperanza	1 13 9
Mexico Mines	6 18 9
Oroville	0 5 0
Stratton'sInd.	0 2 0
Tomboy	1 3 1½

BOSTON EXCH. Oct. 31

Name of Comp.	Clg.
Adventure	4½
Algomah	3¾
Allouez	28
Am. Zinc	22⅜
Arcadian	2
Arizona Com.	45
Atlantic	‡6
Bonanza	35
Boston & Corbin	.05½
Butte & Balak	3¾
Calumet & Ariz	48¾
Calumet & Hecla	385
Centennial	9
Con. Mercur	‡.03
Copper Range	51½
Daly-West	5
East Butte	10
Franklin	6¾
Granby	29
Hancock	19¼
Hedley Gold	‡14½
Helvetia	75
Indiana	5⅝
Isle Royale	13¼
Keweenaw	1⅞
Lake	27⅛
La Salle	4
Live Oak	‡21
Mass	5½
Michigan	1½
Mohawk	40
New Arcadian	‡2¼
North Butte	24½
North Lake	4
Ojibway	4¾
Old Dominion	38
Osceola	87
Parrot	9
Quincy	58
Shannon	7¼
Shattuck-Ariz.	16¾
Superior	21⅛
Superior & Bost.	2½
Tamarack	21
Trinity	3
Tuolumne	‡3.00
U. S. Smelting	31¾
U. S. Smelt'g. pf.	46
Utah Apex	2¼
Utah Con.	15⅛
Victoria	2¾
Winona	3⅜
Wolverine	83⅞
Wyandot	75

BOSTON CURB Oct. 31

Name of Comp.	Last
Ahmeek	175
Bingham Mines	1
Boston Ely	76
Boswycolo	10½
Cactus	24
Calaveras	77
United Verde Ext.	51
Chief Cons	62
Corbin	1 1/16
Cortez	1½
Crown Reserve	2⅞
First Nat. Cop.	1
Majestic	32
Mazatan	40
Moneta Porc.	‡.12
Nat'l Mine & Ex.	07
Nevada-Douglas	2⅞
New Baltic	3½
Oneco	1½
Raven Copper	24
Rhode Island Coal	1⅜
San Antonio	‡3½
South Lake	3⅜
Trethewey	‡.65
United Zinc, pfd.	‡2
Vulture	5
Yuma	‡.02

‡Last quotation.

CHEMICALS, MINERALS, RARE EARTHS, ETC.—CURRENT WHOLESALE PRICES

ABRASIVES—		
Carbons,good drill quality,carat		$50.00@75.00
Carborundum, f.o.b. Niagara Falls, powd.	lb.	.08
Grains	"	.10@.17
Corundum	"	.07@.10
Crushed Steel, f.o.b. Pittsburg	"	.05¾@.06
Emery, in kegs; Turkish flour	"	.01¾@.02
Grains	"	.03½@.04
Naxos flour	"	.01¾@.02
Grains	"	.03½@.04
Chester flour	"	.01½@.02
Grains	"	.03½@.04
Peekskill flour, f.o.b. Easton, Pa	"	.01½@.01¾
Grains, in kegs	"	.02¾@.03
Garnet, per quality	sh. ton	25.00@35.00
Pumice Stone,Am.Powd.,100 lb.		1.60@2.00
Italian, powdered	per lb	.01¾@.01¾
Lump, per quality	"	.03@.30
Rottenstone, ground	"	.02@.04
Lump, per quality	"	.05@.20
Rouge, per quality	"	.05@.30
Steel Emery, f.o.b. Pittsburg	"	.07@.07½
ACIDS—		
Acetic 28%	lb.	.0169@.0209
Boric	"	.07
Hydrofluoric, 30%	"	.02¾@.03½
" 48%	"	.06
" 52%	"	.06½
" 60%	"	.10
Hydrochloric acid, 20° per 100 lb.		1.25@1.50
Nitric acid, 36° to 40°	per lb.	.03¾@.04½
Sulphuric acid,50°,bulk per ton.		$12 up
60°, 100 lb. in carboys.		.85@1.12½
60°, bulk, ton		16.00@18.00
66°, 100 lb. in carboys.		1.00@1.25
66°, bulk, ton		18.00
Oxalic	per lb.	.07¼@.072
ALCOHOL—Grain 95%	gal.	2.60
Denatured	"	.42
Refined wood, 95@97%	"	.52@.57
ALUM—Lump	100 lb.	$1.75
Ground	"	1.85
Chrome Alum	"	.04½@.05
ALUMINUM—Sulphate,com'l.	lb.	.90@1.50
AMMONIA—24 deg	"	.04½@.05½
" 26 deg.	"	.04¾@.05¾
AMMONIUM—		
Bromide	lb.	.36
Carbonate	"	.08@.08½
Muriate gran	"	.05¾@.06
Lump	"	.09½@.09¾
Sulphate, 100 lb.	"	3.10@3.15
Sulpho-cyanide com	"	.25
" " chem. pure	"	.35
ANTIMONY—needle,powder	lb.	.04½@.04¾
Oxide	"	.08½@.10
ARSENIC—white	"	.02@.02¼
Red, Outside brands	"	.05½@.06¼
Saxony	"	.06¼@.06¾
ASPHALTUM—		
Barbadoes	per ton	100.00@170.00
West Indies	"	30.00@60.00
Egyptian	lb.	.30@.40
Gilsonite,Utah ordinary	per ton	36.00@50.00
Trinidad	"	25.00@30.00
California	per ton	22.50@30.00
BARIUM—		
Carb. Lump, 80@90%	lg. ton	26.00@35.00
Precipitated, 96@98%	"	31.00@33.00
Powdered, natural	lb.	.02@.02½
Chloride com'l.	ton	32.50@37.50
Nitrate powdered, in casks.	lb.	.05½@.06½
Blanc Fixe, dry, bbl.	per lb.	.02¾@.04
BARYTES—		
Am. Ground	sh. ton	12.00@13.00
Floated	"	16.00@17.00
Foreign floated	"	18.00@22.50
BLEACHING POWDER—35% 100 lb.		1.17½@1.40
BLUE VITRIOL—(copper sulphate), carload, per 100 lb.		4.50@4.75
BONE ASH	lb.	.02¾@.04
BORAX, sacks	"	.03¼@.04
CALCIUM—Acetate,gray,100 lb.		1.87½@2.00
Carbide, ton lots f.o.b. Niagara Falls, N. Y.	sh. ton	70.00
Chloride, f.o.b. N. Y.	"	8.25@10.00
CEMENT—Slag cement	bbl.	0.75@1.25
Portland, Am. 400 lb	"	1.20@1.30
Foreign	"	2.25@2.90
"Rosendale," 300 lb	"	.85
(in sacks)	"	.65
CHROME ORE—		
New Caledonia 50% ex. ship N. Y.	per lg. ton	14.00@16.00
Bricks, f.o.b. Pittsburg, per M.		175.00
CLAY, CHINA—Am. common ex-dock, N. Y.	ton	8.00@9.00
Foreign	"	11.50@18.00
COBALT—Oxide	lb.	.80@.85
COPPERAS—Bulk	100 lb.	$0.55
In bbls	"	.65@.85
In bags	"	.60@.80
CRYOLITE (carload)	lb.	.06½@.07
FELDSPAR—Ground	sh. ton	8.00@12.00
FIRE BRICK—		
American	per M.	30.00@40.00
Imported	"	30.00@45.00
St. Louis	"	16.00
Extra	"	20.00@23.00
Special extra	"	30.00@35.00
FIRE CLAY—f.o.b. St. Louis.		
St. Louis, extra quality	per ton	5.00
" ordinary	"	2.50
FLUORSPAR—		
Domestic f.o.b. Pittsburg:		
Lump	ton	8.00@10.00
Ground	"	12.00@14.00
Foreign crude ex. dock	"	8.50
FULLER'S EARTH—Lump,100lb.		.80@.85
Powdered	"	.80@.85
GRAPHITE—Ceylon.		
Flying dust, finest to best	lb.	.01@.02
Dust	"	.02@.04
Chip	"	.03@.06
Lump	"	.04@.09
Large lump		.04@.08
GYPSUM—		
Fertilizer	sh. ton	5.00
Ground	"	4.00@7.00
INFUSORIAL EARTH—		
Ground Am. Best	lb	.01½@.02½
German	"	.02¼@.02¾
LEAD—		
Acetate (sugar of)	lb.	.07½@.09⅞
Nitrate, com'l	"	.07¼@.08¼
MAGNESITE—Greece.		
Crude (95%)	lg. ton	7.50@8.50
Calcined, powdered	sh. ton	26.00@35.00
Brick, domes, per qual. f.o.b. Pittsburg	M.	160@200
MAGNESIUM—		
Chloride, com'l	100 lb.	.90@1.25
Sulphate (Epsom salt)	100 lb.	1.00@1.10
MANGANESE—		
Foreign, crude, powdered:		
70@75% binoxide	lb.	.006@.01
75@85% binoxide	"	.011@.015
85@90% binoxide	"	.01¾@.04
90@95% binoxide	"	.06¼@.08½
Ore, 80%-85%	sh. ton	12.00@25.00
MARBLE—Flour	sh. ton	9.00@9.50
MINERAL WOOL—		
Slag, ordinary	sh. ton	19.00
Selected	"	25.00
Rock, ordinary	"	32.00
MONAZITE SAND—		
Guar. 97%, with 5% Thorium oxide, normal	lb.	.08 and up
NICKEL—		
Oxide, crude, lb. (77%) for fine metal contained		.40@.45
Sulphate, single	lb.	.10¼@.11
Sulphate, double	"	.05¼@.08
NITRATE OF SODA—		
100 lb. 95% (spot)		2.20
95% (future, 1911)		2.22½
96% is 2½@7½c. higher per 100 lb.		
OZOKERITE—best	lb.	.14⅞@.15½
PAINTS AND COLORS—		
Litharge, Am. powdered	lb.	.07¼@.07½
English glassmakers'	"	.08¼@.09½
Lithophone	"	.03½@.04
Metallic, brown	sh. ton	18.00@20.00
Red	"	25.00@30.00
Ocher, Am. common	"	12.00@15.00
Best	"	15.00@20.00
Dutch, washed	lb.	.02¾@.03¼
French, washed	"	.01¼@.02
Paris green, pure, bulk	"	.13@.18
Red lead, American	"	.06¼@.07
Foreign	"	.08½@.09
Turpentine, spirits bbl., per gal.		.50@.50½
White lead, Am., dry	lb.	.05½@.06
American, in oil	"	.07¼@.07½
Foreign, in oil	"	.09¾@.10
Zinc white, Am. extra dry	"	.05¾@.06½
French proc's, red seal, dry	"	.08¾
French process, green seal, dry	"	.10¾
PHOSPHATES—Acid	60@62c. per unit	
*Fla., hard rock 77%		5.75@6.00
land pebble 68%		3.70@3.80
†Tenn., 78@80%		5.00@5.50
75%		4.75@5.00
68@72%		4.25@4.50
‡So. Car. land rock 60%		3.50@3.75

*F.o.b. Florida or Georgia ports. †F.o.b. Mt. Pleasant. ‡On vessel Ashley River, S. C.

POTASSIUM—		
Bicarbonate crystal	lb.	$.07½@.08
Powdered or granulated	"	.08@.08½
Bichromate	"	.07¾@.07¾
Bromide	"	.28
Carbonate (80@85%)	"	.03½@.04
Caustic, ordinary	"	.03¾@.05¾
Elect. (90% KOH)	"	.05¼@.05½
Chloride (muriate), 100 lb		1.90
Chlorate, powdered	"	.08½@.09½
Crystals	"	.08¼@.09¼
Cyanide (98@99%)		
Carloads (30,000 lb.)	"	18c.
5-ton lots		18½c.
Less than 5 tons		.19
Kainite, long ton, bulk, 7.50; bags,		8.50
Permanganate	lb.	.09½@.10½
Prussiate, yellow	"	.13@.13¾
Red	"	.26@.30
Sulphate (basis 90%)	100 lb.	2.18@2.21
PYRITE—		
Domestic, non-arsenical, furnace size,f.o.b. R. R.per unit		.12@.12½
Domestic, non-arsenical, fines, per unit, f.o.b. mines		.09½@.11½
Imported, non-arsenical, furnace size, ex-ship, per unit		.13@.13¼
Imported, arsenical, furnace size, ex-ship, per unit		.12½@.12¾
Imported fines,arsenical,ex-ship		.09½@.10
Imported fines, non-arsenical, ex-ship, per unit		.10½@.11

Pyrite prices are per unit of sulphur. A deduction of 25c. per ton is made when ore is delivered in large lumps.

SALT—N. Y. com. fine 280 lb. bbl.		1.05@1.15
N. Y. agricultural	sh. ton	2.90@3.50
SALTPETER—Crude	100 lb.	4.00@4.50
Refined, crystals		5.00@5.75
SILICA—		
Ground quartz, ord'ry	lg. ton	7.00@15.00
Silex, ground	"	7.00@15.00
Silex, floated	"	30.00@40.00
Lump quartz	"	5.00@5.50
Glass sand	"	2.75
SILVER—Nitrate, crystals	oz.	.34@.36
SODIUM—Acetate	lb.	.04½@.05
"Alkali," per 100 lb., 58|48		.90@.95
Bicarb. soda, per 100 lb		1.00@1.30
Soda, caustic, per 100 lb., 78|60		1.70@1.80
Soda, caustic, powdered		.02½@.03
Salt cake, per 100 lb., bulk		.50@.62½
Salt Cake, bbl.		.67½@.80
Soda, monohydrate, per lb.		1.30@1.75
Bichromate	lb.	.05½@.05¾
Bromide	"	.20
Chlorate, com'l	"	.08½@.09½
Cyanide, 120-130% KCN, per 100%		
Carloads (30,000 lb.)	lb.	18c.
5-ton lots	"	18½c.
Less than 5 tons	"	.20
Hyposulphite, Am.	"	1.30@1.50
Phosphate	100 lb.	2.10@2.40
Prussiate	"	.08@.08½
Sal soda, f.o.b. N. Y.	"	.60@.75
Foreign, f.o.b. N. Y.	"	.80@1.00
Silicate, com'l	"	.65@1.00
Sulphate, com'l (Glauber's salt)	100 lb.	.60@.80
Sulphate, com'l, calcined		.65@.85
STRONTIUM—Nitrate	lb.	.07@.08
SULPHUR—Louisiana (prime) to New York	lg. ton	22.00 up
To Boston, Philadelphia or Baltimore	"	22.50 up
Roll	100 lb.	1.85@2.15
Flour	100 lb.	2.00@2.40
Flowers, sublimed	100 lb.	2.20@2.60
Powdered commercial, bags		1.50
Sicilian, extra qual., unmixed seconds, crude brimstone to New York	lg. ton	$22.50
TERRA ALBA—Fr.&Eng. 100 lb.		.75@.90
TALC—Domestic	sh. ton	12.00@25.00
French	"	15.00@25.00
Austrian	"	35.00
Italian, best	"	33.00
TIN—Bi-chloride, 50°	lb.	.12¼
Crystals	"	.25½@.28
Oxide	"	.45
URANIUM—Oxide	"	2.20@4.25
ZINC—Chloride sol., com. 20	lb.	02½
Chloride, granular	"	.04@.04½
Dust	"	.06¾@.07
Sulphate	"	.02@.02½

NOTE.—These quotations are for ordinary wholesale lots in New York unless otherwise specified, and are generally subject to the usual trade discounts. In the cases of some of the important minerals, such as phosphate rock, pyrites and sulphur, in which there are well established markets, the quotations are substantially representative. But in the cases of some of the minor mineral products, the quotations represent what dealers ask of consumers and not what producers can realize in selling their output on private contract.